

**THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES**

Applicant(s): Young et al.
Appl. No.: 10/070,799
Conf. No.: 9555
Filed: September 16, 2002
Title: METHOD FOR IMPROVING THE SKIN AND COAT OF PETS
Art Unit: 1615
Examiner: N.S. Levy
Docket No.: 115808-338

Mail Stop Appeal Brief - Patents
Commissioner for Patents
P.O. Box 1450
Alexandria, VA 22313-1450

APPELLANTS' APPEAL BRIEF

Sir:

Appellants submit this Appeal Brief in support of the Notice of Appeal filed on November 21, 2007. This Appeal is taken from the Final Rejection in the Office Action dated August 24, 2007.

I. REAL PARTY IN INTEREST

The real party in interest for the above-identified patent application on Appeal is Nestec, S.A. by virtue of an Assignment dated September 23, 2002 and recorded at reel 013317, frame 0583-0586 in the United States Patent and Trademark Office.

II. RELATED APPEALS AND INTERFERENCES

Appellants' legal representative and the Assignee of the above-identified patent application do not know of any prior or pending appeals, interferences or judicial proceedings that may be related to, directly affect or be directly affected by or have a bearing on the Board's decision with respect to the above-identified Appeal.

III. STATUS OF CLAIMS

Claims 1, 4, 6, 8, 10, 12, 13, 15-17, 19-24 and 30-33 are pending in the above-identified patent application. Claims 2, 3, 5, 7, 9, 11, 14, 18 and 25-29 were previously canceled. Claims 1, 4, 6, 8, 10, 12, 13, 15-17, 19-24 and 30-33 stand rejected. Therefore, Claims 1, 4, 6, 8, 10, 12, 13, 15-17, 19-24 and 30-33 are being appealed in this Brief. A copy of the appealed claims is included in the Claims Appendix.

IV. STATUS OF AMENDMENTS

A non-final Office Action was mailed March 15, 2007. A final Office Action was mailed on August 24, 2007. In the final Office Action, the Examiner maintained the obviousness rejections. Appellants attach copies of the non-final and final Office Actions as Exhibit A and Exhibit B, respectively, in the Evidence Appendix.

V. SUMMARY OF CLAIMED SUBJECT MATTER

A summary of the invention by way of reference to the specification and/or figures for each of the independent claims is provided as follows:

Independent Claim 1 is directed to a method of maintaining or enhancing the healthy functioning of the skin and coat system of a pet in need of same (page 2, lines 9-10) comprising the step of feeding the pet a food composition (page 2, line 11) comprising a nutritional agent which promotes the growth of bifido- and lactic-bacteria in the gastro-intestinal tract of the pet (page 2, lines 12-13), wherein the nutritional agent comprises a prebiotic that comprises about 0.1% to about 20% by weight of the food composition (page 6, lines 23-28), a probiotic micro-organism that comprises about 0.5% to about 20% by weight of the food composition (page 6, lines 29-34), and a long-chain fatty acid (page 3, line 16).

Independent Claim 6 is directed to a method for improving or maintaining the coat of a pet in need of same (page 2, lines 9-10), the method comprising administering to the pet a nutritional agent which promotes the growth of bifido- and lactic-bacteria in the gastro-intestinal tract of the pet (page 2, lines 12-13), wherein the nutritional agent comprises a prebiotic that comprises about 0.1% to about 20% by weight of a food composition (page 6, lines 23-28), a probiotic micro-organism that comprises about 0.5% to about 20% by weight of a food composition (page 6, lines 29-34), and a long-chain fatty acid (page 3, line 16).

Independent Claim 13 is directed to a method for improving or maintaining the coat of a pet in need of same (page 2, lines 9-10), the method comprising administering to the pet a nutritionally complete pet food which contains a nutritional agent which promotes the growth of bifido- and lactic-bacteria in the gastro-intestinal tract of the pet (page 2, lines 12-13), wherein the nutritional agent comprises a prebiotic that comprises about 0.1% to about 20% by weight of the pet food (page 6, lines 23-28), a probiotic micro-organism that comprises about 0.5% to about 20% by weight of the pet food (page 6, lines 29-34), and a long-chain fatty acid (page 3, line 16).

Independent Claim 20 is directed to a method for improving or maintaining the skin and coat system of a pet in need of same (page 2, lines 9-10), the method comprising administering to the pet a nutritional agent which increases the digestion of nutrients in the gastro-intestinal tract of the pet (page 3, line 11), wherein the nutritional agent comprises a prebiotic that

comprises about 0.1% to about 20% by weight of a food composition (page 6, lines 23-28), a probiotic micro-organism that comprises about 0.5% to about 20% by weight of a food composition (page 6, lines 29-34), and a long-chain fatty acid (page 3, line 16).

Independent Claim 21 is directed to a method for improving or maintaining the skin and coat system of a pet in need of same (page 2, lines 9-10), the method comprising administering to the pet a nutritional agent which improves the microflora balance on the skin of the pet (page 2, lines 30-34), wherein the nutritional agent comprises a prebiotic that comprises about 0.1% to about 20% by weight of a food composition (page 6, lines 23-28), a probiotic micro-organism that comprises about 0.5% to about 20% by weight of a food composition (page 6, lines 29-34), and a long-chain fatty acid (page 3, line 16).

Independent Claim 22 is directed to a method for improving or maintaining shininess and softness of the coat of a pet in need of same (page 2, lines 9-10), the method comprising administering to the pet a nutritional agent which promotes the growth of bifido- and lactic-bacteria in the gastrointestinal tract of the pet (page 2, lines 12-13), wherein the nutritional agent comprises a prebiotic that comprises about 0.1% to about 20% by weight of a food composition (page 6, lines 23-28), a probiotic micro-organism that comprises about 0.5% to about 20% by weight of a food composition (page 6, lines 29-34), and a long-chain fatty acid (page 3, line 16).

Independent Claim 23 is directed to a method for improving or maintaining shininess and softness of the coat of a pet in need of same (page 2, lines 9-10), the method comprising administering to the pet a nutritional agent which increases the digestion of nutrients in the gastro-intestinal tract of the pet (page 3, line 11), wherein the nutritional agent comprises a prebiotic that comprises about 0.1% to about 20% by weight of a food composition (page 6, lines 23-28), a probiotic micro-organism that comprises about 0.5% to about 20% by weight of a food composition (page 6, lines 29-34), and a long-chain fatty acid (page 3, line 16).

Independent Claim 24 is directed to a method of reducing or assisting in the prophylaxis of dandruff in the coat of a pet in need of same (page 3, lines 7-8), the method comprising administering to the pet a nutritional agent which promotes the growth of bifido- and lactic-bacteria in the gastro-intestinal tract of the pet (page 2, lines 12-13), wherein the nutritional agent comprises a prebiotic that comprises about 0.1% to about 20% by weight of a food composition (page 6, lines 23-28), a probiotic micro-organism that comprises about 0.5% to about 20% by weight of a food composition (page 6, lines 29-34), and a long-chain fatty acid (page 3, line 16).

Independent Claim 30 is directed to a method of manufacturing a pet food, the method comprising providing a prebiotic substance that comprises about 0.1% to about 20% by weight of a food composition (page 6, lines 23-28), a probiotic micro-organism that comprises about 0.5% to about 20% by weight of a food composition (page 6, lines 29-34), and a long-chain fatty acid in a pet food composition (page 3, line 16) for giving the coat of a pet animal eating it a flourishing appearance (page 4, lines 7-9).

Independent Claim 31 is directed to a method of reducing dandruff in a coat of a pet animal in need of same (page 3, lines 7-8), the method comprising providing a prebiotic substance that comprises about 0.1% to about 20% by weight of a food composition (page 6, lines 23-28), a probiotic micro-organism that comprises about 0.5% to about 20% by weight of a food composition (page 6, lines 29-34), and a long-chain fatty acid in a pet food composition (page 4, lines 7-9) and administering the pet food composition to the pet animal (page 5, lines 24-25).

Although specification citations are given in accordance with C.F.R. 1.192(c), these reference numerals and citations are merely examples of where support may be found in the specification for the terms used in this section of the Brief. There is no intention to suggest in any way that the terms of the claims are limited to the examples in the specification. As demonstrated by the references numerals and citations, the claims are fully supported by the specification as required by law. However, it is improper under the law to read limitations from the specification into the claims. Pointing out specification support for the claim terminology as is done here to comply with rule 1.192(c) does not in any way limit the scope of the claims to those examples from which they find support. Nor does this exercise provide a mechanism for circumventing the law precluding reading limitations into the claims from the specification. In short, the references numerals and specification citations are not to be construed as claim limitations or in any way used to limit the scope of the claims.

VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL

1. Claims 1, 4, 6, 8, 10, 12, 13, 15-17, 19-24 and 30-33 have been rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent 6,156,355 to Shields et al. ("*Shields*") in view of EP 0862863 to Cavadini et al. ("*Cavadini*") or WO 98/56263 to Marsh et al. ("*Marsh*"). Appellants attach copies of *Shields*, *Cavadini* and *Marsh* herewith as Exhibits C, D and E in the Evidence Appendix.
2. Claims 1, 4, 6, 8, 10, 12, 13, 15-17, 19-24 and 30-33 are rejected under 35 U.S.C. §103(a) as being unpatentable over Lowe ("Canine Nutrition – Recent Advances") ("*Lowe '88*") in view of *Marsh*, *Shields*, LabDiet ("Product Reference Manuel") (*LABDIET '98*), U.S. Patent No. 5,756,088 to Matsuura et al. ("*Matsuura*"), and *Cavadini*. Appellants attach copies of *Lowe '88*, *LabDiet '98* and *Matsuura* herewith as Exhibits F, G and H in the Evidence Appendix.

VII. ARGUMENT

A. LEGAL STANDARDS - Obviousness under 35 U.S.C. § 103

The Federal Circuit has held that the legal determination of an obviousness rejection under 35 U.S.C. § 103 is:

whether the claimed invention as a whole would have been obvious to a person of ordinary skill in the art at the time the invention was made...The foundational facts for the prima facie case of obviousness are: (1) the scope and content of the prior art; (2) the difference between the prior art and the claimed invention; and (3) the level of ordinary skill in the art...Moreover, objective indicia such as commercial success and long felt need are relevant to the determination of obviousness...Thus, each obviousness determination rests on its own facts.

In re Mayne, 41 U.S.P.Q. 2d 1451, 1453 (Fed. Cir. 1997).

In making this determination, the Patent Office has the initial burden of proving a *prima facie* case of obviousness. *In re Rijckaert*, 9 F.3d 1531, 1532, 28 U.S.P.Q. 2d 1955, 1956 (Fed. Cir. 1993). This burden may only be overcome "by showing some objective teaching in the prior art or that knowledge generally available to one of ordinary skill in the art would lead that individual to combine the relevant teachings." *In re Fine*, 837 F.2d 1071, 1074, 5 U.S.P.Q. 2d 1596, 1598 (Fed. Cir. 1988). "If the examination at the initial stage does not produce a prima facie case of unpatentability, then without more the applicant is entitled to grant of the patent." *In re Oetiker*, 24 U.S.P.Q. 2d 1443, 1444 (Fed. Cir. 1992).

Moreover, the Patent Office must provide explicit reasons why the claimed invention is obvious in view of the prior art. The Supreme Court emphasized that when formulating a rejection under 35 U.S.C. § 103(a) based upon a combination of prior art elements, it remains necessary to "determine whether there was an apparent reason to combine the known elements in the fashion claimed by the patent at issue." *KSR v. Teleflex*, 127 S.Ct. 1727, 82 USPQ2d 1385 (U.S. 2007).

Of course, references must be considered as a whole and those portions teaching against or away from the claimed invention must be considered. *Bausch & Lomb, Inc. v. Barnes-Hind/Hydrocurve Inc.*, 796 F.2d 443 (Fed. Cir. 1986). "A prior art reference may be considered to teach away when a person of ordinary skill, upon reading the reference would be discouraged

from following the path set out in the reference, or would be led in a direction divergent from the path that was taken by the Applicant.” *Monarch Knitting Machinery Corp. v. Fukuhara Industrial Trading Co., Ltd.*, 139 F.3d 1009 (Fed. Cir. 1998), quoting, *In re Gurley*, 27 F.3d 551 (Fed. Cir. 1994).

B. THE CLAIMED INVENTION

Independent Claims 1, 6, 13, 20-24 and 30-31 recite, in part, a method of maintaining or enhancing the coat of a pet in need of same comprising the step of feeding the pet a food composition comprising a nutritional agent comprising a prebiotic that comprises about 0.1% to about 20% by weight of a food composition, a probiotic micro-organism that comprises about 0.5% to about 20% by weight of a food composition, and a long-chain fatty acid. Teachings and examples in the specification supporting and elucidating the scope of the present invention include page 2, lines 9-12; page 6, lines 23-28 and 29-34, and page 3, line 16.

C. THE REJECTION OF CLAIMS 1, 4, 6, 8, 10, 12, 13, 15-17, 19-24 AND 30-33 UNDER 35 U.S.C. §103(A) SHOULD BE REVERSED BECAUSE THE CITED REFERENCES FAIL TO DISCLOSE OR SUGGEST ALL THE ELEMENTS OF THE CLAIMS

1. The Cited References

The Examiner in the Final Office Action dated August 24, 2007 asserts that *Shields* in view of *Cavadini* or *Marsh* render obvious Claims 1, 4, 6, 8, 10, 12, 13, 15-17, 19-24 and 30-33. The Examiner also asserts that *Lowe '88* in view of *Marsh*, *Shields*, *LabDiet '98*, *Matsuura* and *Cavadini* render obvious Claims 1, 4, 6, 8, 10, 12, 13, 15-17, 19-24 and 30-33. Even if the cited references are combinable, which Appellants submit they are not, the cited references fail to disclose or suggest every element of independent Claims 1, 6, 20-24 and 30-31.

2. *Shields* in view of *Cavadini* or *Marsh* fail to disclose or suggest every element of Claims 1, 4, 6, 8, 10, 12, 13, 15-17, 19-24 and 30-33

Independent Claims 1, 6, 13, 20-24 and 30-31 recite, in part, a method comprising feeding a pet a food composition comprising a nutritional agent comprising a prebiotic that

comprises about 0.1% to about 20% by weight of a food composition, a probiotic micro-organism that comprises about 0.5% to about 20% by weight of a food composition, and a long-chain fatty acid.

Contrary to the pending claims, *Shields* fails to disclose or suggest a nutritional agent comprising a prebiotic that comprises about 0.1% to about 20% by weight of a food composition as required, in part, by the present claims. The Examiner admitted the same in the non-final Office Action dated March 15, 2007. See, non-final Office Action, page 2 (Exhibit A).

Appellants further submit that *Cavadini* and *Marsh* fail to remedy the deficiencies of *Shields*. With regard to *Cavadini*, the Examiner relied on page 5, lines 22-26 and 54-57 to attempt to remedy the admitted deficiencies of *Shields*. See, non-final Office Action, page 2 (Exhibit A). Specifically, those passages of *Cavadini* state as follows:

The dried, ready-to-eat cereal product conveniently contains about 10^4 to about 10^{10} cells of the probiotic micro-organism per gram of the dried cereal product; preferably about 10^6 to about 10^8 cells of the probiotic micro-organism per gram. The dried cereal product may contain about 0.5% to about 20% by weight of the mixture of the probiotic micro-organism and carrier substrate; preferably about 1% to about 6% by weight; for example about 3% to about 6% by weight.

The amount of the dried, ready-to-eat cereal product to be consumed by the human or animal to obtain a beneficial effect will depend upon the size and age of the human or animal. However, an amount of the dried, ready-to-eat cereal product to provide a daily amount of about 10^6 to about 10^2 cells of the probiotic micro-organism would usually be adequate. [EMPHASIS ADDED]

See, *Cavadini*, page 5, lines 22-26 and 54-57 (Exhibit D). Though the Examiner asserts that *Cavadini* remedies the deficiencies in *Shields*, the above passages clearly describe a dried, RTE product containing probiotic microorganisms rather than prebiotics as required, in part, by the present claims and lacking in *Shields*.

With regard to *Marsh*, the Examiner asserted that *Marsh* remedied *Shields*' deficiencies by relying on the teaching of unspecified probiotic-Brewer's yeast at 1.7% on page 16 of *Marsh*. See, non-final Office Action, page 2 (Exhibit A). Similar to *Cavadini*, however, *Marsh*, at best, teaches use of probiotics rather than prebiotics. In fact, nowhere does *Marsh* teach use of prebiotics at any level. Instead, *Marsh* teaches a dietary supplement comprising zinc and linoleic acid. See, *Marsh*, Abstract (Exhibit E).

The Examiner asserted, however, that it would have been obvious at time of the invention for one of ordinary skill in the canine feed arts to apply the desired amounts and proportions of nutrient and dietary aids to optimize desired effects. Moreover, the Examiner asserted that no

objective showing of non-obvious or unexpected results was shown to distinguish over the prior art. See, non-final Office Action, page 2 (Exhibit A). Appellants respectfully disagree.

Appellants have surprisingly found that administering to a pet a nutritional agent that promotes the growth of bifido- and lactic-bacteria in the gastro-intestinal tract of the pet improves, or at least maintains, the condition of the skin and coat system of the pet. Moreover, increasing the concentrations of bifido- and lactic-bacteria in the gastro-intestinal tract of the pet produces nutrients and/or increases the absorption of nutrients that are responsible for the improvement or maintenance of the condition of the skin and coat of the pet. Further, increasing the concentrations of bifido- and lactic-bacteria in the gastro-intestinal tract of the pet are thought to promote a better microflora balance on the skin or the pet. See, specification, page 3, line 33 to page 4, line 9. Moreover, Appellants have observed that the combination of prebiotic with linoleic-acid rich oil, such as soybean oil, provides unexpected benefits that suggest a synergistic effect. See, specification, page 7, lines 14-17. Further, Appellants' Examples establish that when adding prebiotics into a pet food composition at the claimed ranges, numerous benefits arise such as, for example, increased coat shininess, coat softness, skin hydration score and skin elasticity, as well as reduced transepidermal water loss, oxidative stress, inflammation and dandruff. See, specification, page 9, lines 29-34; page 10, lines 25-31, and page 12, lines 1-3 and 30-33.

Therefore, Appellants establish non-obvious and unexpected results distinguishing the present invention over the prior art. Accordingly, the cited references, taken together, fail to disclose or suggest all the elements of present claims.

3. Lowe '88 in view of Marsh, Shields, LabDiet '98, Matsuura and Cavadini fail to disclose every element of Claims 1, 4, 6, 8, 10, 12, 13, 15-17, 19-24 and 30-33

Independent Claims 1, 6, 13, 20-24 and 30-31 recite a method of maintaining or enhancing the coat of a pet in need of same comprising the step of feeding the pet a food composition comprising a nutritional agent comprising a prebiotic that comprises about 0.1% to about 20% by weight of a food composition, a probiotic micro-organism that comprises about 0.5% to about 20% by weight of a food composition, and a long-chain fatty acid.

Contrary to the pending claims, *Lowe '88*, *LabDiet '98* and *Matsuura* all fail to disclose or suggest a method comprising the step of administering a nutritional agent including a prebiotic that comprises about 0.1% to about 20% by weight of a food composition as required, in part, by the present claims. Rather, each of *Lowe '88*, *LabDiet '98* and *Matsuura* teach, at best, use of probiotic microorganisms. *Lowe '88* teaches that treatment with probiotics, such as yeast cultures, rather than prebiotics of the present claims, can treat metabolic problems that result from dietary hypersensitivity. See, *Lowe '88*, pages 280, 283 and 285 (Exhibit F). Moreover, *LabDiet '98*, much like *Marsh* above, teaches a composition containing a probiotic – brewer's dried yeast – instead of the prebiotic required in the present claims. See, *LabDiet '98* (Exhibit G). Finally, *Matsuura* teaches that probiotics, rather than prebiotics, combined with a polyunsaturated fatty acid and biotin in a prescription diet, can provide prophylaxis against dermatosis. See, *Matsuura*, Abstract and column 2, lines 3-56; see also, specification, page 1, lines 29-32 (Exhibit H).

Further, *Marsh*, *Shields* and *Cavadini*, as discussed above, also fail to disclose or suggest a method comprising the step of administering a nutritional agent including a prebiotic that comprises about 0.1% to about 20% by weight of a food composition as required, in part, by the present claims. Regarding *Shields*, the Examiner admitted the above deficiency in the non-final Office Action dated March 15, 2007. See, non-final Office Action, page 2 (Exhibit A).

Regarding *Marsh*, rather than show evidence in *Marsh* of the use of prebiotics at the levels of the present claims, the Examiner relies on *Marsh* for the teaching of unspecified probiotic-Brewer's yeast at 1.7% on page 16 of *Marsh*. See, non-final Office Action, page 2 (Exhibit A). As a result, *Marsh*, at best, teaches use of probiotics rather than prebiotics. In fact, nowhere does *Marsh* teach use of prebiotics at any level. Instead, *Marsh* generally teaches a dietary supplement comprising zinc and linoleic acid. See, *Marsh*, Abstract (Exhibit E).

Regarding *Cavadini*, the Examiner relied on page 5, lines 22-26 and 54-57 (See, non-final Office Action, page 2 (Exhibit A)), which specifically state as follows:

The dried, ready-to-eat cereal product conveniently contains about 10^4 to about 10^{10} cells of the probiotic micro-organism per gram of the dried cereal product; preferably about 10^6 to about 10^8 cells of the probiotic micro-organism per gram. The dried cereal product may contain about 0.5% to about 20% by weight of the mixture of the probiotic micro-organism and carrier substrate; preferably about 1% to about 6% by weight; for example about 3% to about 6% by weight.

The amount of the dried, ready-to-eat cereal product to be consumed by the human or animal to obtain a beneficial effect will depend upon the size and age of the

human or animal. However, an amount of the dried, ready-to-eat cereal product to provide a daily amount of about 10^6 to about 10^2 cells of the probiotic micro-organism would usually be adequate. [EMPHASIS ADDED]

See, *Cavadini*, page 5, lines 22-26 and 54-57 (Exhibit D). As stated previously, the above passages clearly describe a dried, RTE product containing probiotic microorganisms rather than the prebiotics required by the present claims.

Moreover, *LOWE '88*, *Marsh, Shields, LABDIET '98*, *Matsuura* and *Cavadini* do not even teach or suggest any methods for improving or maintaining the coat of a pet in need of same using a nutritional agent that comprises a prebiotic, a probiotic micro-organism and long-chain fatty acids at the levels detailed above, as required by the present claims. In fact, the Examiner has failed to show any evidence in the cited references regarding a method for improving or maintaining the coat of a pet in need of same or the step of feeding or administering to the pet a nutritional composition including a prebiotic, a probiotic micro-organism and a long-chain fatty acid for improving or maintaining the coat.

The Examiner asserts, however, that the prior art as cited feeds non-specified prebiotics, probiotics, and fatty acids to the same animals as Appellants' and that *Shields* repeatedly recites maintaining healthy skin and coat with omega 3 and 6 fatty acids, chicory root, inulin sources, zinc and probiotic lactobacilli feed as in Example 5 of *Shields*. See, non-final Office Action, page 3 (Exhibit A). Appellants respectfully disagree with the Examiner for the following reasons.

First, Appellants have established above that each of the references is deficient with respect to the present claims. Each reference fails to disclose or suggest (a) any methods for improving or maintaining the coat of a pet in need of same and (b) a method comprising the step of administering a nutritional agent including a prebiotic that comprises about 0.1% to about 20% by weight of a food composition.

Second, contrary to the Examiner's assertion regarding *Shields*, Appellants submit that when *Shields* actually refers to skin and hair coat problems in pets, *Shields* only teaches the use of fatty acids to combat the problem, rather than a disclosure of prebiotics as required by the claims. Specifically, *Shields* states:

Skin and hair coat problems have been noted in several breeds including the Chinese Shar Pei, the Chow Chow and the Miniature Poodle. This problem is also accounted for in the subject breed-specific formulations. In addition to a generous supply

of vitamins (B-vitamins, vitamin A) and minerals (zinc and copper in proteinate form which is more available for deposition in hair), the Group Specific Formulas incorporate the latest in fatty acid supplementation technology available today. This involves a careful balance of total omega-6 and omega-3 fatty acids (ratio 4-11) as well as supplementation of a balance of short and long chain compounds in these major classifications to facilitate inflammation management. This is the reason for the supplementation of evening primrose oil and salmon oil in addition to canola oil in the subject formulations. This blend provides insurance for pets which may have low enzyme activities. [EMPHASIS ADDED]

See, *Shields*, column 10, lines 36-48 (Exhibit C).

Third, regardless of what the Examiner asserts regarding *Shields*' disclosure of prebiotics, the Examiner still admits that *Shields* fails to disclose or suggest the specific prebiotic range of the present claims. Moreover, Appellants have established that the remaining references also fail to disclose or suggest this same range. Further, as discussed previously, Appellants' Examples establish that when adding prebiotics into a pet food composition at the claimed ranges, numerous benefits arise such as, for example, increased coat shininess, coat softness, skin hydration score, skin elasticity, reduced transepidermal water loss, reduced oxidative stress, reduced inflammation, and reduced dandruff. See, specification, page 9, lines 29-34; page 10, lines 25-31, and page 12, lines 1-3 and 30-33. Therefore, Appellants establish non-obvious and unexpected results distinguishing the present invention over the prior art.

Accordingly, the combination of *Lowe '88*, *Marsh*, *Shields*, *LabDiet '98*, *Matsuura* and *Cavadini* fail to disclose or suggest every element of the present claims.

VIII. CONCLUSION

Appellants respectfully submit that the Examiner has failed to establish a *prima facie* case of obviousness under 35 U.S.C. §103(a) with respect to the rejection of Claims 1, 4, 6, 8, 10, 12, 13, 15-17, 19-24 and 30-33. Accordingly, Appellants respectfully submit that the obviousness rejections are erroneous in law and in fact and should therefore be reversed by this Board.

Appellants submit a one-month extension fee of \$120.00 herewith. The Director is authorized to charge any other fees that may be required, or to credit any overpayment to Deposit Account No. 02-1818. If such a withdrawal occurs, please indicate the Attorney Docket No. 115808-338 on the account statement.

Respectfully submitted,

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BY _____
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Dated: February 21, 2008

CLAIMS APPENDIX
PENDING CLAIMS ON APPEAL OF
U.S. PATENT APPLICATION SERIAL NO. 10/070,799

1. A method of maintaining or enhancing the healthy functioning of the skin and coat system of a pet in need of same comprising the step of feeding the pet a food composition comprising a nutritional agent which promotes the growth of bifido- and lactic-bacteria in the gastro-intestinal tract of the pet, wherein the nutritional agent comprises a prebiotic that comprises about 0.1% to about 20% by weight of the food composition, a probiotic micro-organism that comprises about 0.5% to about 20% by weight of the food composition, and a long-chain fatty acid.

4. A method according to claim 1 in which the prebiotic is selected from the group of inulin, fructooligosaccharides and plant materials which contain inulin and/or fructooligosaccharides.

6. A method for improving or maintaining the coat of a pet in need of same, the method comprising administering to the pet a nutritional agent which promotes the growth of bifido- and lactic-bacteria in the gastro-intestinal tract of the pet, wherein the nutritional agent comprises a prebiotic that comprises about 0.1% to about 20% by weight of a food composition, a probiotic micro-organism that comprises about 0.5% to about 20% by weight of a food composition, and a long-chain fatty acid.

8. A method according to claim 6 in which the nutritional agent is administered as a supplement to the pet's normal diet.

10. A method according to claim 6 in which the prebiotic is selected from the group of inulin, fructooligosaccharides and plant materials which contain inulin and/or fructooligosaccharides.

12. A method according to claim 6 in which the pet food further comprises a zinc source.

13. A method for improving or maintaining the coat of a pet in need of same, the method comprising administering to the pet a nutritionally complete pet food which contains a nutritional agent which promotes the growth of bifido- and lactic-bacteria in the gastro-intestinal tract of the pet, wherein the nutritional agent comprises a prebiotic that comprises about 0.1% to about 20% by weight of the pet food, a probiotic micro-organism that comprises about 0.5% to about 20% by weight of the pet food, and a long-chain fatty acid.

15. A method according to claim 13 in which the prebiotic is selected from the group of inulin, fructooligosaccharides and plant materials which contain inulin and/or fructooligosaccharides.

16. A method according to claim 13 in which the pet food contains about 0.1% to about 5% by weight of a prebiotic fiber as the nutritional agent.

17. A method according to claim 13 in which the pet food contains about 10^4 to about 10^{11} cells of a probiotic micro-organism per gram of the pet food as the nutritional agent.

19. A method according to claim 13 in which the pet food further comprises a zinc source.

20. A method for improving or maintaining the skin and coat system of a pet in need of same, the method comprising administering to the pet a nutritional agent which increases the digestion of nutrients in the gastro-intestinal tract of the pet, wherein the nutritional agent comprises a prebiotic that comprises about 0.1% to about 20% by weight of a food composition, a probiotic micro-organism that comprises about 0.5% to about 20% by weight of a food composition, and a long-chain fatty acid.

21. A method for improving or maintaining the skin and coat system of a pet in need of same, the method comprising administering to the pet a nutritional agent which improves the microflora balance on the skin of the pet, wherein the nutritional agent comprises a prebiotic that comprises about 0.1% to about 20% by weight of a food composition, a probiotic micro-organism that comprises about 0.5% to about 20% by weight of a food composition, and a long-chain fatty acid.

22. A method for improving or maintaining shininess and softness of the coat of a pet in need of same, the method comprising administering to the pet a nutritional agent which promotes the growth of bifido- and lactic-bacteria in the gastrointestinal tract of the pet, wherein

the nutritional agent comprises a prebiotic that comprises about 0.1% to about 20% by weight of a food composition, a probiotic micro-organism that comprises about 0.5% to about 20% by weight of a food composition, and a long-chain fatty acid.

23. A method for improving or maintaining shininess and softness of the coat of a pet in need of same, the method comprising administering to the pet a nutritional agent which increases the digestion of nutrients in the gastro-intestinal tract of the pet, wherein the nutritional agent comprises a prebiotic that comprises about 0.1% to about 20% by weight of a food composition, a probiotic micro-organism that comprises about 0.5% to about 20% by weight of a food composition, and a long-chain fatty acid.

24. A method of reducing or assisting in the prophylaxis of dandruff in the coat of a pet in need of same, the method comprising administering to the pet a nutritional agent which promotes the growth of bifido- and lactic-bacteria in the gastro-intestinal tract of the pet, wherein the nutritional agent comprises a prebiotic that comprises about 0.1% to about 20% by weight of a food composition, a probiotic micro-organism that comprises about 0.5% to about 20% by weight of a food composition, and a long-chain fatty acid.

30. A method of manufacturing a pet food, the method comprising providing a prebiotic substance that comprises about 0.1% to about 20% by weight of a food composition, a probiotic micro-organism that comprises about 0.5% to about 20% by weight of a food composition, and a long-chain fatty acid in a pet food composition for giving the coat of a pet animal eating it a flourishing appearance.

31. A method of reducing dandruff in a coat of a pet animal in need of same, the method comprising providing a prebiotic substance that comprises about 0.1% to about 20% by weight of a food composition, a probiotic micro-organism that comprises about 0.5% to about 20% by weight of a food composition, and a long-chain fatty acid in a pet food composition and administering the pet food composition to the pet animal.

32. A method according to claim 30 wherein the composition includes chicory.

33. A method according to claim 32 wherein the composition further includes soybean oil.

EVIDENCE APPENDIX

EXHIBIT A: Non-Final Office Action dated March 15, 2007.

EXHIBIT B: Final Office Action dated August 24, 2007.

EXHIBIT C: U.S. Patent 6,156,355 to Shields et al. ("*Shields*"), cited by the Examiner in the Non-Final Office Action dated March 15, 2007.

EXHIBIT D: EP 0862863 to Cavadini et al. ("*Cavadini*"), cited by the Examiner in the Non-Final Office Action dated March 15, 2007.

EXHIBIT E: WO 98/56263 to Marsh et al. ("*Marsh*"), cited by the Examiner in the Non-Final Office Action dated March 15, 2007.

EXHIBIT F: Lowe ("*Canine Nutrition – Recent Advances*") ("*Lowe '88*"), cited by the Examiner in the Non-Final Office Action dated March 15, 2007.

EXHIBIT G: LabDiet ("*Product Reference Manuel*") ("*LABDIET '98*"), cited by the Examiner in the Non-Final Office Action dated March 15, 2007.

EXHIBIT H: U.S. Patent No. 5,756,088 to Matsuura et al. ("*Matsuura*"), cited by the Examiner in the Non-Final Office Action dated March 15, 2007.

RELATED PROCEEDINGS APPENDIX

None

Exhibit

A



UNITED STATES PATENT AND TRADEMARK OFFICE

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www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/070,799

09/16/2002

Linda A. Young

112701-338

9555

29157 7590 03/15/2007
BELL, BOYD & LLOYD LLP
P.O. Box 1135
CHICAGO, IL 60690

EXAMINER

LEVY, NEIL S

ART UNIT

PAPER NUMBER

1615

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
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3 MONTHS

03/15/2007

PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.

10/070,799

Applicant(s)

YOUNG ET AL.

Examiner

NEIL LEVY

Art Unit

1615

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(c).

Status

- 1) ☒ Responsive to communication(s) filed on 12 December 2006.
2a) ☐ This action is FINAL. 2b) ☒ This action is non-final.
3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1, 4, 6, 8, 10, 12, 13, 15-17, 19-24 and 30-33 is/are pending in the application.
4a) Of the above claim(s) _____ is/are withdrawn from consideration.
5) ☐ Claim(s) _____ is/are allowed.
6) ☒ Claim(s) 1, 4, 6, 8, 10, 12, 13, 15-17, 19-24, 30-33 is/are rejected.
7) ☐ Claim(s) _____ is/are objected to.
8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-943)
3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
5) ☐ Notice of Informal Patent Application
6) ☐ Other: _____

DETAILED ACTION

Claim Rejections - 35 USC § 103

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 1, 4, 6, 8, 10, 12, 13, 15-17, 19-24, & 30-33 are rejected under 35 U.S.C. 103(a) as being unpatentable over SHIELDS et al 6156355 in view of CAVADIN et al EPO862863 or MARSH et al WO98/5263.

SHIELDS, of record provides the instant benefits to skin and coats of pets in need thereof (Examples 5, 6) at the instant concentration of omega 3 and 6 fatty acids (1-5%), inulin (0.5-10%) and feeds the fatty acids, prebiotics, chicory, zinc and probiotics. The amounts of prebiotics are not specified.

CAVADIN (page 5, lines 22-26, and 54-57) shows how much is added to pet food; so does MARSH (page 16) of the unspecified instant probiotic-Brewer's yeast at 1.7%.

It would have been obvious at the time of the instant invention for one of ordinary skill in the canine feed arts to incorporate these ingredients of known efficacy with known diets at levels chosen to optimize desired parameters of performance. It would be within the purview of one in the pet arts to find it obvious to apply the desired amounts and proportions nutrient and dietary aids to optimize desired effects. Further, no objective showing of non-obvious or unexpected results is shown by the applicant to distinguish over the prior art use of the particular ingredients.

Claims 1, 4, 6, 8, 10, 12, 13, 15-17, 19-24, 30-33 stand rejected under 35 U.S.C. 103(a) as being unpatentable over LOWE '88 in view of Marsh-WO 98/56263 & Shields & LAB DIET '98, Matsuura et al 5756088 & Cavadini et al EP 0862863.

Applicant's arguments filed 12/12/06 have been fully considered but they are not persuasive.

Applicant argues prior art fails to show the instant methods of maintaining or enhancing healthy skin function. However, the prior art as cited feeds non-specified prebiotics, probiotics, and fatty acids to the same animals as applicant's, thus would find the same effects. SHIELDS repeatedly recites maintaining healthy skin and coat, with omega 3 and 6 fatty acids, chicory root, and inulin sources, zinc and probiotic lactobacilli feed as Example 5.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to NEIL LEVY whose telephone number is 571-272-0619. The examiner can normally be reached on Tuesday-Friday, 7 AM to 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, MICHAEL WOODWARD can be reached on 571-272-8373. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Application/Control Number: 10/070,799

Art Unit: 1615

Page 4

A handwritten signature in black ink, appearing to read "Neil Levy", with a stylized flourish at the end.

NEIL LEVY
Primary Examiner
Art Unit 1615

Exhibit B



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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/070,799

09/16/2002

Linda A. Young

112701-338

9555

29157 7590 08/24/2007
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CHICAGO, IL 60690

EXAMINER

LEVY, NEIL S

ART UNIT

PAPER NUMBER

1615

NOTIFICATION DATE

DELIVERY MODE

08/24/2007

ELECTRONIC

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Notice of the Office communication was sent electronically on above-indicated "Notification Date" to the following e-mail address(es):

PATENTS@BELLBOYD.COM

Office Action Summary

Application No.

10/070,799

Applicant(s)

YOUNG ET AL.

Examiner

NEIL LEVY

Art Unit

1615

– The MAILING DATE of this communication appears on the cover sheet with the correspondence address –
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
 - If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
 - Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 18 June 2007.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1, 4, 6, 8, 10, 12, 13, 15-17, 19-24 and 30-33 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1, 4, 6, 8, 10, 12, 13, 15-17, 19-24, & 30-33 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

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- 1) ☐ Notice of References Cited (PTO-892)
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- 3) ☐ Information Disclosure Statement(s) (PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

Art Unit: 1615

DETAILED ACTION

The text of those sections of Title 35, U.S. Code not included in this action can be found in a prior Office action.

Claims 1, 4, 6, 8, 10, 12, 13, 15-17, 19-24, & 30-33 stand rejected under 35 U.S.C. 103(a) as being unpatentable over SHIELDS et al 6156355 in view of CAVADIN et al EPO862863 or MARSH et al WO98/5263.

Claims 1, 4, 6, 8, 10, 12, 13, 15-17, 19-24, 30-33 stand rejected under 35 U.S.C. 103(a) as being unpatentable over LOWE '88 in view of Marsh-WO 98/56263 & Shields & LAB DIET '98, Matsuura et al 5756088 & Cavadini et al EP 0862863.

Response to Arguments

Applicant's arguments filed 6/18/07 have been fully considered but they are not persuasive. Applicant argues SHIELDS has no per cent of prebiotic, or method statement of improvement of skin, while secondary references only address probiotics.

One of ordinary skill in nutrition would find it obvious to combine references promoting the advantages of probiotic added to a diet, while the inulin and other prebiotics would be reasonable for one to incorporate at levels known in the art and within ranges of the claimed per cent. Whatever effects would result are a function of the feeding, to improve health and nutrition.

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory

period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to NEIL LEVY whose telephone number is 571-272-0619. The examiner can normally be reached on Tuesday-Friday, 7 AM to 5:30 PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, MICHAEL WOODWARD can be reached on 571-272-8373. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Art Unit: 1615

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NEIL LEVY
Primary Examiner
Art Unit 1615

Exhibit C

United States Patent [19]

Shields, Jr. et al.

US00615635A

[11] Patent Number: 6,156,355

[45] Date of Patent: Dec. 5, 2000

[54] BREED-SPECIFIC CANINE FOOD FORMULATIONS

[75] Inventors: Richard G. Shields, Jr., Newport, Ky.;
Jeffrey P. Bennett, Corona, Calif.

[73] Assignee: Star-Kist Foods, Inc., Newport, Ky.

[21] Appl. No.: 09/245,067

[22] Filed: Feb. 5, 1999

Related U.S. Application Data

[60] Provisional application No. 60/107,033, Nov. 2, 1998.

[51] Int. Cl.⁷ A23K 1/175

[52] U.S. Cl. 426/74; 426/61; 426/805;
426/650

[58] Field of Search 426/74, 61, 805,
426/650

References Cited

U.S. PATENT DOCUMENTS

5,851,573 12/1998 Lepine et al. 426/74
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Groom and Board, vol. 20(1), pp. 11-15, Jan./Feb., 1998.

Pet's First Products, Website: pets1st.com, 1995.

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Canine Caviar, website: www.caninecaviar.com, 1997.

Primary Examiner—Chhaya D. Sayala

Attorney, Agent, or Firm—Burns, Doane, Swecker &
Mathis, L.L.P.

ABSTRACT

[57] Breed-specific dog food formulations that comprise chicken meat as the major ingredient, rice as the predominant (or sole) grain source, fruit and/or vegetable fiber as the primary or sole fiber source, unique fat and antioxidant blend, vitamins, herbs and spices, carotenoids, and no corn or artificial colors, preservatives, flavors or sugars are provided.

7 Claims, No Drawings

BREED-SPECIFIC CANINE FOOD FORMULATIONS

RELATED APPLICATIONS

This application claims benefit of priority to provisional application Serial No. 60/107,033, filed Nov. 2, 1998, the contents of which are incorporated by reference in their entirety herein.

FIELD OF THE INVENTION

This invention is related to pet food formulations designed based on the unique characteristics of different breeds.

BACKGROUND OF THE INVENTION

A wide variety of different dog food formulations of the wet and dry type are commercially available, e.g., from grocery, pet specialty and veterinary sources. Typically, such dog food formulations are generic in that they are designed to be consumed by any breed. However, some dog food formulations are specialized at least to the extent that they are preferably consumed by dogs of different ages, e.g., puppy, adult and geriatric dog formulations are widely available. Typically, such formulations differ in their caloric, protein, and fat content. Also, dog food formulations adapted for obese dogs are prevalent in the industry. Such dog food formulations, as might be expected, typically have a lower caloric content and higher fiber content relative to other dog food formulations.

In fact, there are many excellent premium pet foods in the marketplace which address the nutritional needs of pets from different perspectives. A good example of pet food formulations that address nutritional needs based on specific age are the Nature's Recipe Original® products. These diets address specific nutrient needs during an individual life stage. These diet lines differ widely with respect to the true differences among life stages. Because of the wide differences in rate at which breeds mature and absolute life-span differences, determination of the appropriate time to switch diets can be quite difficult. Other products address different energy requirements among pets, some of which may have a genetic component. The Puppy/Performance/Lactation, Maintenance and Senior/Pension Lamb Meal & Rice Formulations incorporate a range of dietary energy levels as wide as any in the industry.

An additional segment of the pet food market incorporates differences in ingredient usage or product form. These fill the needs of some pet owners for taste and variety. Nature's Recipe® diets are well-represented in this segment as well since diets are formulated using a single meat protein source, allowing for true ingredient diversity. Many other product lines are fairly similar in ingredient selection with only minor differences in formulations. Relative to product form, Nature's Recipe Original® includes a complementary line of dry and canned products. Additionally, within canned products they offer a choice of ground or formed (carved) products.

A final segment of the pet food market which has been recently introduced involves formulations for specific breeds and/or adult weight. The Nature's Recipe® Group Specific Formulas excel in this category as they consider differences in nutrient requirements and physical form (size and mouth configuration) among breeds.

Such formulations have been developed in part because canine breeds differ from each other both on the outside and

the inside. These differences include some of the more obvious things, including size at maturity, mouth and body dimensions. They also differ with respect to how fast they reach their mature weight. Some breeds, such as the Miniature Dachshund, reach mature body weight at approximately eight months of age while the Newfoundland takes over two years. This makes a huge difference in the physiological maturity of the dam at breeding age.

Although not marked, differences do exist in the digestibility of nutrients among breeds. While no comprehensive research for all breeds has been done, some research conducted by the present inventors has suggested that Toy Fox Terriers had a lower digestibility coefficient for the same diet than the Beagle or Brittany, and that daily energy requirements to maintain body weight are lower for Miniature Poodles and higher for German Shorthairs and Cocker Spaniels, and several in the Terrier group, appear to be predisposed to obesity.

Finally, the ingredient tolerance and nutrient metabolism differ among breeds. This may result in different "normal" blood measurements. Published research has documented that, at least during the reproductive cycle, the Brittany has inherently lower levels of some standard blood measurements than the Beagle or Labrador Retriever. Some of these differences result from efficiencies of various enzyme systems in the body while others are the result of actual genetic abnormalities which accumulate over generations of breeding.

There have been 350-400 genetic disorders identified in dogs, compared to approximately 3,200 in humans. These disorders have been identified in approximately seventy percent of the recognized breeds and the prevalence in all dogs is thought to be approximately twenty-five percent. These genetic difficulties include anatomical malformations, errors of metabolism and genetic predispositions to conditions including cancer, bleeding disorders, and drug reaction. Often times the problem is an enzyme deficiency or defect in a specific structural protein in the body. This, in turn, results in a deficiency of some compound required by the body, a build-up of a compound at unusually high levels, or adaptation of metabolic pathways in the body to compensate for the problem. In the latter situation, clinical signs may not be evidenced or may only manifest themselves at times of high nutrient need. Some genetic defects are lethal either to the developing fetus or early in life, while others are not life-threatening.

Many of these conditions are inherited recessively and do not show up until two dogs which are carriers are bred. Unfortunately, screening tests are not available for many conditions and breeders often find out about problems only after a stud dog has been bred to numerous females. A carrier with an excellent show record can, therefore, spread the gene rapidly. It has been estimated that a single stud dog could represent five to ten percent of the entire genetic make-up of some rare breeds. Inbreeding per se is not necessarily the cause of expression of genetic problems but does expose them more readily. All biological organisms accumulate mutations over time and those which have fatal consequences become self limiting. Moreover, genetic defects are not exclusive to purebreds. It has been estimated that mixed breed dogs have 102 known defects, which is greater than many purebred breeds with a high incidence such as Cairn Terriers (37) and Cocker Spaniels (52). The reason for this is that many breeds have common genetic defects.

As indicated above, many healthy humans have genetic defects which force them to consume special diets. Any person who drinks a diet cola will find the phrase "phenylketonurics: contains phenylalanine" because some people have an inability to metabolize this amino acid (protein building block) so they should try to limit consumption. Another well known condition is lactose intolerance (inability to digest and utilize milk sugar) present in humans, especially those of Asian, Southern European, or African decent. The lack of persistence of the ability to digest milk after weaning is carried as a recessive gene. This situation is easily handled by avoidance of milk or consumption of enzymes which assist this digestion. A minority of the population in unable to regulate cholesterol synthesis in response to dietary intake, but it seems to be a dietary consideration in all of us. Incidence of most of the chronic diseases which occur in the geriatric population, including degenerative joint disease, heart disease, liver disease and diabetes also likely have genetic components.

Thus, pets, similar to humans, exhibit significant genetic diversity which affects their overall health and nutritional requirements. Therefore, notwithstanding the many different types of pet food formulations, and more specifically dog food formulations commercially available, there still exists a prevalent need for improved formulations that take into account the significant genetic differences between different breeds.

OBJECTS OF THE INVENTION

Accordingly, it is an object of the invention to provide improved dog food formulations designed for specific breeds that are designed based on the genetic diversity of different dog breeds.

More specifically, it is an object of the invention to provide dog food formulations that are designed taking into account the different food allergies of different dog breeds.

Still more specifically, it is an object of the invention to provide dog food formulations that comprise the following unique combination of ingredients and features:

- (i) chicken meat and/or meal as the primary ingredient (and only meat source);
- (ii) rice as the primary grain source;
- (iii) unique antioxidant blend;
- (iv) unique fat blend
- (v) organic minerals;
- (vi) unique fiber blend;
- (vii) specific combinations of herbs and species;
- (viii) no added artificial colors or preservatives, flavors or sugars; and
- (ix) nutrition substantiation through AAFCO feeding studies.

More specifically, it is an object of the invention to provide pet food formulations having the above ingredients and features wherein:

- (1) the total digestibility ranges from 85-90%;
- (2) there are no meat products other than chicken meat and/or meal;
- (3) it lacks any corn;
- (4) it comprises a blend of vitamins including tocopherols, vitamin C (ascorbic acid), minerals (copper, zinc and iron in inorganic and organic complex form), carotenoids (e.g., beta carotene and lutein), and herbs (including rosemary);
- (5) a fat blend including canola oil, salmon oil and evening primrose oil;

(6) fruit and/or vegetable fiber rather than grains, such as tomato pomace, as the primary fiber source.

(7) herbs and spices including spearmint, ginger, ginseng, ginkgo, parsley and *Yucca schottigera* extract; and

(8) kibble size, shape, feed recommendations tailored to specific breed.

Still more specifically, it is an object of the invention to provide a dog food formulation specially designed for sporting dogs. In particular, formulations designed for sporting dogs will comprise rice, no gluten-containing grains, taurine, Vitamin E, selenium, and herbs, and are fortified with sodium bicarbonate and minerals, such as calcium, and organic compounds such as glucosamine. Also, this formulation has higher percentage of fat calories and energy relative to other breed formulations. This diet is made in a unique triangle shape which resembles the mouth dimensions of breeds in this group.

It is another more specific object of the invention to provide a dog food formulation that comprises the foregoing ingredients and features which is specifically designed for working dogs that contains a high percentage of fat, higher vitamin and mineral fortification, and which is fortified with a number of antioxidants, choline, garlic, Hawthorn berry powder, and taurine, and minerals including calcium, and organic compounds such as glucosamine, potassium citrate, and sodium.

It is still another specific object of the invention to provide dog food formulations that comprises the foregoing general ingredients and features that are specifically adapted for non-sporting dogs. Such formulations will comprise, in particular, sodium hexametaphosphate, and significant amounts of Vitamin A, B Vitamins, and minerals such as copper and zinc.

It is yet another object of the invention to provide a dog food formulations that comprise the foregoing general ingredients and features that are specifically designed for herding dogs. The herding dog formulations comprise higher vitamin and mineral supplements, such as calcium, potassium citrate, and sodium, and organic compounds such as glucosamine, and additionally comprise oat and barley fiber, direct-fed microbials (DFM), and bromelain (to aid digestion).

It is still another object of the invention to provide dog food formulations that comprise the foregoing general ingredients and features which are specifically designed for Terrier dogs. These formulations comprise higher protein and immediate fat content, lower copper and higher zinc, garlic and milk thistle powder.

It is another specific object of the invention to provide dog food formulations comprising the above features and ingredients that are designed for Toy breeds. These formulations further comprise sodium bicarbonate and potassium chloride, garlic powder, cranberry powder, niacin, B-vitamins, yeast, and have a small kibble size because of the small size of Toy breeds.

It is another object of the invention to provide dog food formulations which additionally comprise the foregoing general ingredients and features that are specifically designed for hounds. These formulations comprise higher vitamin and mineral levels, glutamine, oat and barley fiber, direct-fed microbials (DFM), garlic and cranberry juice powder.

DETAILED DESCRIPTION OF THE INVENTION

The breed-specific dog formulations of this invention were originally developed because of a recognized food

sensitivity observed in different types of dogs which undoubtedly had a genetic component. Numerous well-recognized problems exist in individual breeds, including a Vitamin A responsive dermatitis in Cocker Spaniels and zinc-responsive dermatitis in Siberian Huskies and Alaskan Malamutes. An additional example is the presence of a gluten intolerance in Irish Setters which closely resembles celiac disease in humans and manifests itself as weight loss and chronic, intermittent diarrhea. German Shepherds and Beagles, on the other hand, appear to experience diarrhea caused by a gastrointestinal immune deficiency. Hip dysplasia has been identified in over 100 breeds including several in the Herding, Working and Sporting group. The cause of this condition is likely multifactorial in nature, but dietary management may play a role in expression of the condition. Some Cocker Spaniels and Golden Retrievers appear to have low blood taurine levels which are responsive to dietary taurine supplementation, similar to the cat. Dalmatians are recognized as having predisposition to deafness and presence of uric acid crystals in the urine. Several breeds within the Working Group, including Boxers, Doberman Pinschers, and Great Danes, can develop a heart condition called cardiomyopathy. Bedlington Terriers and West Highland Terriers can experience a copper storage disease. Poodles have been recognized as having somewhat of a predisposition toward periodontal disease.

The pet food formulations of this invention, which are commercially available under the trademark Nature's Recipe Group Specific Formulas[®] are designed to meet the unique needs of pets within various breed groups. They share many common characteristics which make them excellent choices for any pet and some unique characteristics which may add additional value for specific breed groups. Common Features of Feed Formulations of the Invention

The novel breed-specific dog food formulations of the invention now being sold under the name Nature's Recipe Group Specific Formulas[®] contain many common features which collectively make them unique both from previously available Nature's Recipe[®] products and other pet food formulations. These include:

Chicken meat as the number one ingredient—15–30%, preferred 20–25%.

Rice as the primary grain source—20 to 45%.

Unique antioxidant blend—Tocopherols (0.025 to 0.05%), Vitamin C, beta carotene, lutein (from marigold extract), lycopene (from tomato pomace), and rosemary, ginkgo and ginseng

Organic minerals—0.1 to 0.2%

Unique fiber blend—0.5 to 4%

Herbs and Spices—0.05 to 0.2%

No added artificial colors, preservatives, flavors or sugars

Nutrition substantiation through AAFCO feeding studies.

The combination of chicken meat, quality grains, such as rice, and herbs and spices, assures unique taste and nutrition. Total digestibility of these formulations ranges from 85–90%, well above those of competitive pet food products. Preferably, the crude protein of the subject formulations will range from about 20 to 30% minimum, more preferably about 22 to 26% minimum.

Free radicals which form upon exposure to the environment or during normal metabolism can be harmful to cell membranes, proteins and genetic material which can have adverse consequences on the quality of the food and to the body as well. Accordingly, the subject formulations comprise a balanced blend of antioxidants with respect to solubility (fat or water soluble), stage of rancidity in which

they act (oxygen scavengers, free radical termination), and tissues in which they concentrate in the body. Additionally, some antioxidants are complementary and others antagonistic to one another, so balance of these antioxidants is crucial. Accordingly, the subject formulations have been designed to incorporate a blend of vitamins (tocopherols, Vitamin C (ascorbic acid), minerals (copper, zinc and iron in both inorganic and organic complex form), carotenoids (such as beta carotene and lutein from marigold extract) and herbs (including rosemary), to perform this very important function.

Moreover, the formulations of the invention comprise a unique fat blend which includes canola oil, salmon oil, and evening primrose oil to complement the excellent fat quality of the chicken fat. Canola oil and salmon oil are used as sources of short and long-chain omega-3 fatty acids, while evening primrose oil provides an omega-6 fatty acid called gamma linolenic acid (GLA). The latter two fat sources bypass the need for some key enzymes required in fatty acid metabolism. The present inventors hypothesize that both the ratio of omega-6 to omega-3 fatty acids and the absolute quantities of individual representative compounds is significant to the nutritional requirements of dogs.

Preferably, the minimum amount of canola oil will range from 1 to 5.0 percent, the minimum amount of salmon oil from 0.1 to 0.6 percent, and the minimum amount of evening primrose oil from 0.1 to 0.4 percent. Amount will vary depending on the dietary fat content to maintain levels and ratios of fatty acid groups.

Also, the subject formulations comprise a blend of inorganic minerals and mineral proteinates. The latter form may improve vitamin (and therefore antioxidant) stability since some minerals, such as copper and iron, are pro-oxidants. Because they are metabolized differently than inorganic minerals their availability is also generally higher so the body rather than the stool benefits from the minerals in the diet. Examples thereof include zinc oxide, zinc proteinate, ferrous sulfate, iron proteinate, manganous oxide, copper sulfate, copper proteinate, calcium iodate, sodium selenite, and potassium citrate.

Also, in Nature's Recipe products, fruit and/or vegetable fiber (e.g., tomato pomace) is incorporated as a primary fiber source to maintain normal gastrointestinal function. This is a high quality, moderately fermented fiber in contrast to grain fibers which are more slowly fermented. Additionally, in the Group Specific Formulas, chicory root extract is added which serves as a source of soluble fiber. This material, a source of inulin, has been reported in both humans and pets to promote the growth of beneficial bacteria. Generally, the amounts thereof are sufficient to provide a crude fiber content ranging from 0.5 to 10%, more preferably about 2 to 4% maximum.

Several herbs and spices which are widely used as supplements for humans and pets are added to the subject pet food formulations, including spearmint, ginger, ginseng, ginkgo, parsley, and *Yucca schidigera* extract. These ingredients contribute to the unique aroma and taste of the pet food formulations of the invention. Other herbs and plant materials that may be included comprise milk thistle powder, marigold extract, rosemary, chicory, and cranberry juice extract.

Also, the subject pet food formulations are naturally preserved and are free of added artificial colors and flavors. Chicken is the only meat protein source used and no corn is used in these formulations.

The subject pet food formulations are also designed taking into account feeding studies to ensure nutritional

adequacy. The subject pet food formulations, when properly used, should also satisfy the nutrient ranges established in the AAFCO Nutrient Profiles. This should provide the ultimate assurance of nutritional quality.

Thus, the subject formulations sold under the Nature's Recipe Group Specific Formulas® collectively share some novel ingredients which make them unique relative to competitive products. This includes the use of chicken meat as the primary ingredient, and the only meat-derived material, the use of a more complete antioxidant blend including vitamins, carotenoids, spices and herbs, a unique blend of fats and oils including canola oil, salmon oil and primrose oil, the use of mineral proteinate, a unique fiber blend including tomato pomace and chicory extract, and inclusion of several herbs which are commonly consumed by humans for wellness reasons. The combination of these features provides a formula of both outstanding palatability, digestibility and potential wellness support. The utilization of these diets by the pet exceeds that of any dry diet ever tested at our research facility.

In addition to the common features listed above, the subject breed-specific formulations contain other unique features. These differences include the kibble size and shape, the feeding recommendations, the bag sizes offered (to maintain product freshness), as well as the ingredients and nutrient levels. The variety of shapes and sizes includes a triangle Sporting Diet, square Terrier Diet, rectangular Non-Sporting Diet, almond shaped Hound Diet and round Toy, Working and Herding Diets in variable diameter and thickness appropriate for their sizes.

Specifically, each diet is uniquely different as well with respect to specific nutrient targets (both nutrients listed in the standard AAFCO Nutrient Profile and some potential conditionally essential nutrients which may be of benefit in specific animals), ingredients excluded to prevent intolerances (protein sources and food additives) and functional ingredients. These adjustments have been made because the size and shape outside and metabolism inside differs among breed groups or at least among some lines within these groups. The size and shape of the kibbles were selected based on the range of sizes and mouth configurations within a group in an attempt to encourage consumption. This may help to explain why the diets appear to perform even better in homes where the animal-diet relationship is in harmony compared to a research palatability panel with animals of multiple groups. Feeding directions are also modified both with respect to puppy feeding levels which are restricted in breed groups susceptible to bone and joint abnormalities and for adults in breeds predisposed to obesity. Also, additional choline is added which may reduce carnitine excretion.

Each of the diets incorporates the latest in nutrition and wellness technology. Because these diets are preventative rather than therapeutic in nature and complete with respect to nutrition, there is little harm if animals are not fed the recommended diet. With the common benefits present in these diets, each of these diets provide unsurpassed nutritional delivery compared to competitive products even if the added benefit of breed adjustment is ignored. With this general understanding of the invention, more specific embodiments are described below.

Unique Features of the Sporting Diet Formulation

The Sporting formula contains the highest energy level per cup and the highest percentage of fat calories among the subject breed-specific formulations because of the calorie demands of exercise. Vitamin and mineral fortification as well as choline is also higher in this diet to aid in the processing of nutrients into energy as well as to provide

electrolytes. The level of rice in this formula is also higher to support superior digestibility. Exercise increases the generation of free radicals which may be detrimental to the body, so this diet is well fortified with a wide array of antioxidants. The diet is supplemented with sodium bicarbonate (baking soda) to adjust the mineral balance of the diet. This Supplement is widely used in racing horse diets.

Some Irish Setters have been recognized to exhibit an intolerance to gluten which resembles celiac disease in humans. This problem is still not completely understood but thought to result from an intestinal permeability defect in these animals. It is generally handled by avoidance of gluten-containing grains, especially wheat. Barley, rye and oats contain lower levels of gluten and are tolerated by some humans having this condition. However, in the interest of caution, rice is the only grain included in the sporting dog formulation.

Another interesting condition occurs in Cocker Spaniels and likely some Golden Retrievers which have low blood

taurine levels that may respond to dietary supplementation. This nutrient is typically added to cat diets but responses in dogs have been unrecognized until recently. It is possible that this nutrient may be of benefit in other breeds as well but research has been limited to this point. The reason for the difference in normal blood levels among breeds is not well known. Several other nutrients/ingredients which act as antioxidant sources are also added including vitamins (such as vitamins E and C), carotenoids, minerals (such as selenium), and herbs (such as rosemary).

Garlic, hawthorn berry powder (for antioxidant activity and cardiac tonicity) and glutamine are also added to this product.

Finally, bone and joint problems have been identified in some of the Sporting breeds, including the Brittany, Irish Setter, Cocker Spaniel and Labrador Retriever. Since the latter two breeds can suffer from obesity as well as adults, feeding reductions of 15% (relative to other breeds) have been recommended for these two breeds. This may have added benefit for bone and joint problems. Additionally, puppy feeding directions are reduced by a similar amount relative to standard for all breeds within this group for similar reasons. Nutrients necessary for bone and joint health including zinc, copper, and vitamin C are added in appropriate amounts and our unique blend of fats and *Yucca schidigera* extract to help manage joint inflammation. Mineral balance is also carefully controlled and glucosamine added.

Based on the foregoing, this formulation represents the most tailored Group-Specific Formula with respect to nutrient diversity, digestibility and incorporation of unique ingredients.

Unique Features of the Working Diet

The Working formulation of the invention contains a high percentage of fat calories to support the calorie demands of exercise. Vitamin and mineral fortification is also higher in this diet to aid in the processing of nutrients into energy as well as to provide electrolytes. The formula comprises a high level of rice to support the high digestibility of this diet. Exercise increases the generation of free radicals which may be detrimental to the body, so this diet is well fortified with a wide array of antioxidants. Choline is also supplemented to aid in fat transport and metabolism. Garlic, hawthorn berry powder and taurine are also added to this product.

An added consideration in the Working diet is maintenance of proper body condition to help manage the additional stress on the skeletal structure. Puppy feeding directions for the entire group have been reduced by 15%

(compared to previous Nature's Recipe feeding directions) to reduce weight gain during growth. Feeding management should also be monitored during the adult period as this is a high energy diet. This also reduces the daily delivery of calcium by a similar extent which may be beneficial for some large breed dogs such as Great Danes which are unable to manage excesses of dietary calcium. No salt is added to manage dietary sodium to the extent possible and dietary acid-base balance is managed with potassium citrate to manage calcium mobilization from bone since meat-based diets and growth itself provide an acid load to the body. Glucosamine is also added for the same reasons as the Herding formulation.

The Working formula represents an excellent choice for Working dogs as well as any breed exposed to moderate stress or exercise level. The diet contains additional beta glucan fiber from oats and barley. A lot of time and attention went into the development of this diet since the inventors have extensive personal experience in raising and showing breeds in this group.

The Working formula has a generous energy allowance and high digestibility to accommodate the energy needs of this group. As with all Group Specific Formulas, digestibility is quite high. Vitamin and mineral supplementation is also higher in this group to allow it to use this energy.

The Working diet is also managed to the extent possible through dietary means to promote proper cardiovascular function. Dilated cardiomyopathy has been noted in Doberman, Great Danes and Boxers as well as many other species. In this condition the left ventricle is extremely thin and a heart murmur is identified. The form present in Boxers is different from that in the other breeds listed above. In some animals of this breed, carnitine, a natural compound of the body which promotes fat transfer in the body, has been found to be of benefit in delaying mortality from this condition. Therefore, choline is supplemented to all the Group Specific Formulas to help reduce carnitine excretion from the body. The building blocks of this compound are also supplemented. The managed sodium level present for promotion of bone and joint function may also be of benefit in heart health, and with the level of sodium in meat products, salt addition should be unnecessary. Hawthorn berry powder is also added to this diet. They contain a mixture of bioflavonoids which have antioxidant activity and may reduce blood pressure. Potassium supplemental as is done in this formula may also have modest benefits in this regard.

The antioxidants present in all of the diets including vitamins, minerals, carotenoids, spices and herbs as well as the omega 3 and GLA oils added to these diets for inflammation management should also assist in prevention of problems.

Many antioxidant nutrients have been found to be of some benefits in cardiomyopathies of different species, including selenium, a mineral, in livestock and taurine, an amino acid-like compound in cats and some dog breeds such as Cocker spaniels and Golden Retrievers. As a precaution, the Working diet is supplemented with both selenium and taurine as extensive research has not been conducted in all breed groups and the nutrients will do no harm at the level of supplementation utilized.

Unique Features of the Non-sporting Diet

The Non-Sporting formula is highly digestible but contains a managed level of protein and fat calories. These characteristics make this diet an excellent choice for mixed breed dogs, for spayed and neutered pets or for pet owners desiring to control protein and fat calories. The mineral

balance is adjusted by the use of sodium hexametaphosphate. In fact, the Non-Sporting formula, because of its high energy level, without excessive use of protein or fat, serves as an excellent all-purpose diet both for Non-Sporting and mixed breed dogs.

The Non-Sporting group probably has as wide a diversity of pet types as any group. The diet designed for them is a moderate protein, moderate calorie diet which serves as our recommendation for mixed breed dogs of normal activity. For those engaged in extreme activity, the Sporting formula would then be recommended.

The most well-recognized problem of this group which is diet responsive is urate crystals in Dalmatians. Because of the extreme dietary adjustments required for this breed, we generally consider this condition to be a candidate for a veterinary medical diet. In fact, many pets of this breed have been fed Nature's Recipe Vegetarian Canine Formula as it has several attributes thought to be beneficial for prevention of this condition. This breed was not ignored in the dietary formulation of the Non-Sporting formula, however. The total protein level in this formula is managed because it is this nutrient group which is ultimately the source of uric acid. Additionally, the meat protein source is meat muscle tissue rather than meat by-products since the latter is higher in nucleic acids.

As stated previously, the Vegetarian Formula would be better still in this respect. Additionally, this condition is best addressed in a more alkaline urine and the Non-Sporting formula, because of the specific mineral balance associated with ingredients such as sodium hexametaphosphate, should promote a more alkaline diet than any of the other Group Specific Formulas. Although certainly not proven scientifically, chicory root has been used in humans for gout to increase uric acid excretion, likely resulting on its effects on the liver or as a diuretic in the kidney.

Skin and hair coat problems have been noted in several breeds including the Chinese Shar Pei, the Chow Chow and the Miniature Poodle. This problem is also accounted for in the subject breed-specific formulations. In addition to a generous supply of vitamins (B-vitamins, vitamin A) and minerals (zinc and copper in protein form which is more available for deposition in hair), the Group Specific Formulas incorporate the latest in fatty acid supplementation technology available today. This involves a careful balance of total omega-6 and omega-3 fatty acids (ratio 4:11) as well as supplementation of a balance of short and long chain compounds in these major classifications to facilitate inflammation management. This is the reason for the supplementation of evening primrose oil and salmon oil in addition to canola oil in the subject formulations. This blend provides insurance for pets which may have low enzyme activities.

Since most true food allergens are proteins, management of dietary protein is important. This is why the total protein level is managed and a single source (chicken) is used in our formulations. Additionally, as with all Nature's Recipe products, natural preservatives and flavors are used and no colorants are added to the subject formulations. Since proteins can sometimes be found in unrefined fats and oils typically used in the pet food industry, we use highly refined human grade oils that are shipped under a nitrogen blanket to ensure freshness and retard oxidation.

A final dietary adjustment made only in the Non-Sporting formula is the use of agents to help control tartar accumulation. Some breeds including Poodles and Bichon Frise are thought to accumulate tartar at greater rates than others and/or suffer from a higher rate of periodontal disease. The present formulations comprise a patented tartar control agent

called sodium hexametaphosphate which has been licensed exclusively to Heinz. It has been reported in peer-reviewed journals that this agent reduces the rate of tartar accumulation 80% when added in a complete meal. Until now this ingredient has only been added to pet treats. However, with dentists telling us to brush after every meal it was decided that it would be beneficial to incorporate such ingredient in the subject formulations so it would be consumed more frequently. Other ingredients such as bromelain and cranberry extract have also been reported to improve oral health and promote healing and are additionally included in this formulation.

Unique Features of The Herding Diet

The Herding formula is an excellent diet which provides a high energy level without excessive use of fat. It has been tested with police dogs in training, so it should serve the needs of pets in less stressful environments.

More specifically, some breeds in the herding group such as German Shepherds suffer from a gastrointestinal immune deficiency which manifests itself through chronic, intermittent diarrhea. Additionally, many of the breeds in this group as well as Working and Sporting group suffer from numerous bone and joint abnormalities, including hip and elbow dysplasia, panostitis, and degenerative joint disease.

Since most breeds can experience diarrhea on occasion, particularly in response to stress, all Group Specific Formulas share a combination of ingredients to help maintain gastrointestinal function. One of these is the inclusion of high levels of rice which, in addition to being highly digestible, contain compounds which actually inhibit intestinal secretions. The diets also contain spearmint and ginger, thought to inhibit nausea which may lead to gastrointestinal disturbances. They also contain a blend of fruit and/or vegetable fibers (e.g., tomato pomace), chicory extract and *Yucca schidigera* extract which provide unique benefits relative to gastrointestinal health. The specific fibers used are moderately fermented similar to beet pulp but of more health origin (additionally provide antioxidants). While fiber used to be thought of as a filler, it is now recognized that fiber is important for intestinal health. Chicory extract contains inulin, the parent compound of fructooligosaccharides (FOS) found in IVD Select Care formulas and more recently in EukanuBA diets. This compound is termed a "prebiotic" in that it can be utilized by beneficial microorganisms like bifidobacteria and lactobacillus but not be harmful ones including *Salmonella*, *Clostridia* and *E. coli*. Simply put, it is food for good bugs. The chicory extract is a natural extract of the chicory root while the FOS used by EukanuBA is a fermentation product of sugar. Both chicory extract and *Yucca schidigera* extract act to bind bacterial toxins and ammonia and help to reduce stool odor. This effect has been noted both in humans and pets.

The unique fats and oils used in this product line also help to control inflammation both in gastrointestinal disturbances and in joint inflammation. Zinc in both inorganic and proteinate form is provided to assist in repair of intestinal cell damage. High levels of zinc have been used in many species with intestinal disorders with excellent results.

While these ingredient adjustments provide excellent protection of gastrointestinal function, the Herding diet adds other unique ingredients to protect this particular organ. One way is through the use of microbial cultures (probiotics or DFM) which provide beneficial organisms to the pet. This concept is similar to yogurt. They are added after the extrusion process to protect them from heat damage. In this particular formula a combination of *Lactobacillus acidophilus*, *Bacillus subtilis* and *Enterococcus faecium* is

used because of their complementary action. Microbial cultures serve as a source of enzymes to help digest food, competitively exclude harmful bacteria, and synthesize various B vitamins and antimicrobial compounds. The combination of probiotics and prebiotics in the same product as a 1-2 punch has been termed "synbiotics" and is the most current trend in progressive yogurt cultures. In addition to the enzymes in these microbial cultures, the Herding diet contains bromelain, an extract of pineapple which contains a complex of several protein-digesting enzymes to complement the pet's natural digestive capabilities. A final ingredient which is supplemented is glutamine. This compound is a natural component of the body which is the primary fuel source for the intestinal cells and in particular immune cells of the gastrointestinal tract. It plays a similar role to butyric acid, provided by fiber fermentation, for health of cells of the colon. Although it may not help healthy animals at rest, it may be of benefit in stress conditions including weaning to prevent muscle breakdown as a source of this amino acid. In addition to the addition of these many functional ingredients, the calories from fat are reduced in the Hound diet.

The total calories are similar to many premium diets because of the high digestibility of this diet. The reason for the reduced fat is that, in the presence of gastrointestinal disturbances, fat digestion is most compromised and results in stool malodor from bacterial fermentation of fat. The fat management helps reduce the harm caused by intestinal dysfunction. The level of vitamin and trace mineral supplementation is higher in this diet than some of the other Group Specific Formulas to help utilization of energy, particularly in pets under stress.

As indicated previously, dietary adjustments are also made to ensure proper bone and joint function. Feeding instructions have been altered to a 15% reduction relative to groups with minimal bone and joint problems during the puppy phase and breeds with a propensity for obesity such as Collies and Shetland Sheepdogs reduced by a similar amount during the adult phase to minimize weight burden on the joints. Daily calcium consumption is also managed by this dietary restriction as it appears that the puppy of at least some large breeds are unable to regulate its calcium absorption. Sodium is also restricted to help minimize calcium mobilization from the bone as urinary sodium and calcium excretion run parallel to one another. Functional ingredients such as glucosamine are added to enhance proteoglycan synthesis and prevent its destruction. Aspirin and ibuprofen suppress pain but in fact suppress proteoglycan synthesis, preventing the body to self repair damage. Potassium citrate is used to adjust the mineral (acid-base) balance of the body and hopefully enhance bone mineral deposition. Research with several species including cats has indicated that diets with a low mineral balance (more acid in nature) cause bone demineralization. This would be particularly harmful in growing animals since bone formation itself generates acid. Bromelain has also been found to be of some benefit in joint disorders, perhaps through some yet unknown indirect anti-inflammatory mechanism.

As with intestinal disorders, all diets contain some dietary components to promote strong bones and joint function including the fatty acids listed above as well as potentially the yucca extract to control joint inflammation, manganese supplementation (cofactor in enzymes in chondroitin synthesis), zinc supplementation (protein and DNA synthesis), iron and vitamin C (for the hydroxylation of proline during collagen formation) and copper (for cross-linking of collagen molecules to provide cartilage strength)

as well as biotin and choline (for proteoglycan formation and aggregation). The ingredients listed above are added in the diets specifically designed for breed groups with a high propensity of bone and joint problems, including Herding dogs.

Unique Features of the Terrier Diet

The diet for this group has a fairly high protein level and high fat level relative to its total calories to meet the needs of the active terrier group. For breeds such as Cairn and Scottish Terriers, which may be "easy keepers" adult feeding directions recommend a 15% reduction relative to other breeds within this group.

A well-recognized problem within this group is a liver copper storage disease present in Bedlington Terriers and West Highland Terriers. It is estimated that in the former breed both England and the United States that approximately 25% of the animals are affected and an additional 50% are carriers as it is transmitted as an autosomal recessive gene. This condition bears some resemblance to Wilson's disease in humans which has an estimated worldwide incidence of approximately 1 in 30,000. This condition is characterized by a toxic accumulation of copper in the liver and brain, resulting in tremors, psychiatric disturbances, and liver degeneration in humans. This condition is typically treated by a combination of dietary copper restriction and additional zinc supplementation.

In humans, liver consumption is not recommended although recent studies have suggested that while copper in beef liver is highly available, that in pork is not. Zinc supplementation reduces the retention of copper in the body and thus has an indirect beneficial effect. Level of copper supplementation is lower and zinc higher in the Terrier formula than in any of the other Group Specific Formulas. Milk thistle has been added as a complementary ingredient to help maintain liver health. It contains a group of compounds called the silymarin complex of bioflavonoids. It both helps bind toxins to complement healthy liver function stimulates the production of several potent antioxidants (glutathione and superoxide dismutase) to protect the liver cells from oxidation and finally is thought to stimulate protein synthesis in the liver to enhance repair. This herb has been the subject of hundreds of clinical studies and has been supplemented in Europe for humans with alcoholism, chronic hepatitis and liver cirrhosis.

Unique Features of the Toy Diet

The Terrier formula is highly digestible but contains a managed level of protein and intermediate fat calories, ideal for the needs of active Toy breeds.

More specifically, the Toy formula is managed in protein and contains a high proportion of fat calories relative to several Group Specific Formulas. The rationale behind this is that some of the dogs in this group such as Pugs and Pekinese are brachycephalic and are somewhat intolerant of heat stress. Digestion and metabolism of protein generates more heat. Also, digestion and metabolism of fat generates less heat than carbohydrates. Consequently, these adjustments of protein and fat may be beneficial, particularly when pets are in warm environments or exercising outdoors in the summer. Additionally, sodium bicarbonate and potassium chloride are included to help encourage water consumption and to provide electrolytes. Chromium (from yeast) is incorporated since it appears in some species to reduce cortisol levels present when animals are exposed to stressors.

Additionally, it has been noted that some breeds such as Silky Terriers and Yorkshire Terriers are susceptible to diabetes. Certainly energy management to maintain optimum body condition is useful. As noted, chromium (from

yeast) is supplemented, as well as niacin in this diet. These nutrients are thought to co-participate in a complex known as glucose tolerance factor which is thought to act to improve insulin sensitivity in the body. Additionally, results of recent research suggest that barley has a lower glycemic index in pet than other common grains such as corn or wheat or especially rice. This diet has the highest amount of barley among this line of products. It should be noted that such supplementation acts as a complement, not replacement to insulin administration (frequently required in canine diabetes).

Several breeds including the Yorkshire Terrier, Toy Poodle, Pomeranian, Shih Tzu, Affenpinscher and Pekinese can suffer from oxalate urinary calculi which are responsive to diet mineral adjustment away using alkalinizing minerals such as sodium bicarbonates. Additionally, unlike cats, many of the stones in dogs are complicated by urinary tract infections. Cranberry extract is added to this formulation. This latter ingredient is widely utilized in humans for urinary tract infections and is thought to prevent bacterial adhesion to the urinary tract.

The small size of the Toy formula is also designed based on the relatively small mouth size of Toy breeds.

Unique Features of the Hound Diet

The Hound formula is an excellent diet which provides a high energy level without excessive use of fat. It has a very unique shape relative to any commercial diet. Specifically, the Hound formulation contains a high protein level but managed fat level. Many of the hound breeds are extremely lean and therefore would have a higher protein requirement. Some, however, such as Basset Hounds, Dachshunds and Beagles can become overweight with age and so a caloric reduction of 15% is similarly recommended for these breeds. Additionally, because of their relative body dimensions (short and long), disc disease can occur in Dachshunds and maintaining a lean body is important to reduce the stress on the vertebrae.

Similar to some of the Herding dogs, several animals in the Hound group including the Basenji, Beagle and Whippet can experience chronic, intermittent diarrhea. In the case of the Beagle it may result from a deficiency of intestinal immunity which resembles that in German Shepherds. To attempt to counteract this condition, all of the various ingredients mentioned previously for the Herding diet are added to the Hound formulation. This includes the addition of a high level of rice, a combination of probiotics (microbial cultures) and prebiotics (chicory root extract-inulin) which is termed synbiotics, inclusion of bromelain to assist in digestion, spearmint and ginger to soothe the stomach, glutamine and zinc to promote intestinal cell repair, and a blend of soluble and insoluble fibers to optimize intestinal environment. Additionally, garlic is thought to have some natural ability to inhibit growth of pathogenic organisms. The unique fat blend should help moderate intestinal inflammation.

In contrast to the Toy formula discussed earlier, the Hound diet is formulated with a more acid mineral balance as some breeds in this group such as Basset Hounds are more predisposed to struvite rather than oxalate urinary calculi. Cranberry extract is again added as a safeguard since bacterial infections can complicate this condition. Potassium citrate is still added to help complex calcium and reduce risked calcium oxalate stones as well. It is our belief that a moderate diet containing a mineral balance promoting a moderately acid urine combined with magnesium and citrate is a more effective approach to urinary tract health than an extreme diet which helps with one type of stone such as

stravite but increases susceptibility to the other (such as calcium oxalate). From the standpoint of dogs susceptible to struvite stones, this diet should provide the most acidic urine among this diet line and is therefore likely to be most effective.

In order to further facilitate an understanding of the invention, the following examples are provided.

EXAMPLE 1

Non-Sporting Dog Formulation

A non-sporting dog formulation was formulated to provide for managed protein, moderate energy, highly digestible diet using wholesome grains like ground rice, rolled oats and cracked pearly barley. This product is formulated to maximize the benefits of good nutrition to all parts of the body, including the gastrointestinal tract. The formula includes Spearmint as well as Bromelain and is formulated to help maintain oral health. Herbs such as Ginkgo, Ginseng and Parsley assist in overall good pet health. This unique combination of ingredients provides excellent taste and 100% complete and balanced nutrition for all life stages.

This unique formulation for the NON-SPORTING GROUP breeds also contains a blend of Canola Oil, Salmon Oil and Evening Primrose Oil, a source of GLA (gamma linolenic acid), naturally preserved with Tocopherols. This, in combination with Chicken, provides an optimum balance from the full spectrum of polyunsaturated fatty acids including Omega 6 and Omega 3 for maintaining healthy skin and hair coat. In addition, this formula contains a special blend of antioxidant vitamins and minerals to prevent or neutralize the damaging effects of free radicals.

The specific ingredients in this formulation are as follows: Chicken, Ground Rice, Rolled Oats, Chicken Meal, Cracked Pearled Barley, Natural Flavor, Canola Oil (Preserved with Mixed Tocopherols, Rosemary Extract and Citric Acid), Bone Phosphate, Tomato Pomace, Brewers Dried Yeast, Sodium Hexametaphosphate, Chicory Root Extract, Potassium Chloride, Vitamins (Choline Chloride, Vitamin A Supplement, Vitamin D₃ Supplement, Vitamin E Supplement, Inositol, Niacin, Ascorbic Acid [Source of Vitamin C], d-Calcium Pantothenate, Thiamine Mononitrate, Riboflavin Supplement, Beta Carotene, Pyridoxine Hydrochloride [Vitamin B₆], Folic Acid, Menadiolone Sodium Bisulfite Complex [Source of Vitamin K activity], Biotin, Vitamin B₁₂ Supplement), Sodium Chloride, Salmon Oil, Evening Primrose Oil, Minerals (Zinc Oxide, Zinc Proteinate, Ferrous Sulfate, Iron Proteinate, Manganous Oxide, Copper Sulfate, Copper Proteinate, Calcium Iodate, Sodium Selenite), Potassium Citrate, Ginkgo Biloba Extract, *Yucca schidigera* Extract, Garlic Powder, Panax Ginseng Root Powder, Chinese Ginseng Root, Spearmint Leaf Powder, Eyebright Powder, Siberian Ginseng Extract, Parsley Seed Oil Powder, Ginger Extract, Bromelain, and Mari-

gold Extract.

Animal feed testing according to the procedures of the Association of American Feed Control Officials have shown that this formulation has a complete and balanced diet for all stages of life. The analysis of this formulation is provided below.

ANALYSIS

CRUDE PROTEIN	22.0%	MINIMUM
CRUDE FAT	12.0%	MINIMUM
CRUDE FIBER	4.0%	MAXIMUM
MOISTURE/	10.0%	MAXIMUM
CALCIUM	1.1%	MINIMUM
PHOSPHORUS	0.85%	MINIMUM
OMEGA-6 FATTY ACIDS	2.75%	MINIMUM
OMEGA-3 FATTY ACIDS	0.3%	MINIMUM
GAMMA LINOLENIC ACID	0.02%	MINIMUM

*Not recognized as an essential nutrient by the AAFCO Dog Food Nutrient Profile.

The kibble shape of this formulation was specifically designed based on size, weight, and breed of dogs belonging to this particular group, as were the designated feeding guidelines below. The Non-Sporting Diet is shaped as a rectangle with length nearly 3 times the width. It is an extremely narrow kibble approximately 7 mm wide. This unique shape encourages chewing which may participate in its tartar control effects.

American Eskimo Dog	Dalmatian	Poodle
Bichon Frise	Finnish Spitz	Schipperke
Boston Terrier	French Bulldog	Shiba Inu
Bulldog	Keeshond	Tibetan Spaniel
Chinese Shar Pei	Lhasa Apso	Tibetan Terrier
Chow Chow		

As discussed, the nutritional requirements of dogs vary according to breed, age, size, activity and environment. From weaning to six months of age, feed the recommended amount in 3 feedings per day. Over six months of age, feed the recommended amount in 2 feedings per day. It is recommended that the subject formulation be consumed based on the following recommended guidelines.

Daily Feeding Guidelines

Weight of Dog (lbs.)	Weaning to 6 Months	6-12 Months	Greater Than 12 Months †
3-10	1¼-2¼ Cups	¾-2 Cups	¾-1½ Cups
10-15	2¾-3½ Cups	2-2½ Cups	1½-1¾ Cups
15-25	3½-5 Cups	2½-3¼ Cups	1¾-2½ Cups
25-50	5-8 Cups	3¾-6 Cups	2½-4 Cups
50-75	8-10¾ Cups	6-7¾ Cups	4-5¼ Cups

Measurements are based on a standard 8 oz. cup which equal approximately 3.5 oz. of dry kibble.

† For gestation and lactation feed as much as 3 times the amount indicated in 3 feedings per day.

EXAMPLE 2

Toy Dog Formulation

As discussed above, the formulation for the TOY GROUP breeds contains a blend of Canola Oil, Salmon Oil and Evening Primrose Oil, a source of GLA (gamma linolenic acid), naturally preserved with Tocopherols. This, in combination with Chicken, provides an optimum balance from the full spectrum of polyunsaturated fatty acids including

Omega 6 and Omega 3 for maintaining healthy skin and hair coat. In addition, this formula contains a special blend of antioxidant vitamins and minerals to prevent or neutralize the damaging effects of free radicals.

A Toy dog formulation was produced comprising the following ingredients: Chicken, Ground Rice, Rolled Oats, Chicken Meal, Cracked Pearled Barley, Natural Flavor, Canola Oil (Preserved with Mixed Tocopherols, Rosemary Extract and Citric Acid), Tomato Pomace, Brewers Dried Yeast, Bone Phosphate, Chicory Root Extract, Potassium Chloride, Sodium Bicarbonate, Vitamins (Choline Chloride, Vitamin A Supplement, Vitamin D₃ Supplement, Vitamin E Supplement, Inositol, Niacin, Ascorbic Acid [Source of Vitamin C], d-Calcium Pantothenate, Thiamine Mononitrate, Riboflavin Supplement, Beta Carotene, Pyridoxine Hydrochloride [Vitamin B₆], Folic Acid, Menadione Sodium Bisulfite Complex [Source of Vitamin K activity], Biotin, Vitamin B₁₂ Supplement), Salmon Oil, Evening Primrose Oil, Minerals (Zinc Oxide, Zinc Proteinate, Ferrous Sulfate, Iron Proteinate, Manganese Oxide, Copper Sulfate, Copper Proteinate, Calcium Iodate, Sodium Selenite), Ginkgo Biloba Extract, *Yucca schidigera* Extract, Garlic Powder, Panax Ginseng Root Powder, Chinese Ginseng Root, Spearmint Leaf Powder, Eyebright Powder, Cranberry Juice Concentrate, Siberian Ginseng Extract, Parsley Seed Oil Powder, Ginger Extract, and Marigold Extract. The analysis of this formulation is provided below.

ANALYSIS

CRUDE PROTEIN	22.0% MINIMUM
CRUDE FAT	12.0% MINIMUM
CRUDE FIBER	4.0% MAXIMUM
MOISTURE	10.0% MAXIMUM
CALCIUM	1.0% MINIMUM
PHOSPHORUS	0.60% MINIMUM
NIACIN	100 mg/kg MINIMUM
CHROMIUM	2.0 mg/kg MINIMUM
OMEGA-6 FATTY ACIDS	3.0% MINIMUM
OMEGA-3 FATTY ACIDS	0.3% MINIMUM
GAMMA LINOLENIC ACID	0.03% MINIMUM

*Not recognized as an essential nutrient by the AAFCO Dog Food Nutrient Profile.

As with the previous formulation, animal feeding tests using the procedures of the Association of American Feed Control Officials indicate that this formulation provides complete and balanced nutrition for all stages of life.

Again, for this formulation, the kibble shape was specifically designed based on size, weight, and breed of dogs belonging to this particular group, as were the designated feeding guidelines below. The Toy diet is a small cylindrical kibble of diameter 8.5 mm, the smallest of the round kibble in this line. This smaller round kibble fits nicely in the mouth of many Toy breeds with small square mouths.

Affenpinscher	Japanese Chia	Pomeranian
Brussels Griffon	Maltese	Toy Poodle
Cavalier King Charles	Toy Manchester	Pug
Spaniel	Terrier	
Chihuahua	Miniature Pinscher	Shih Tzu
Chinese Crested	Papillon	Silky Terrier
English Toy Spaniel	Pekingese	Yorkshire Terrier
Italian Greyhound		

Feeding Guidelines

It is recommended that from weaning to six months of age, the recommended amount be fed three times per day.

Over six months of age, it is recommended that this be reduced to two feedings per day.

Daily Feeding Guidelines

Weight of Dog (lbs.)	Weaning to 6 Months	6-12 Months	Greater Than 12 Months †
2-5	¾-1½ Cups	¾-1½ Cups	¾-¾ Cups
5-10	1½-2½ Cups	1½-1¾ Cups	¾-1¼ cups
10-15	2½-3¼ Cups	1½-2½ Cups	1¼-1½ cups
15-25	3¼-4 ¼ Cups	2½-3¾ Cups	1¾-2¼ Cups

Measurements are based on a standard 8 oz. cup which equal approximately 3.5 oz. of dry kibble.

†For gestation and lactation feed as much as 3 times the amount indicated in 3 feedings per day.

EXAMPLE 3

Terrier Dog Formulation

As discussed supra, the TERRIER GROUP breed formulation contains a blend of Canola Oil, Salmon Oil and Evening Primrose Oil, a source of GLA (gamma linolenic acid), naturally preserved with Tocopherols. This, in combination with Chicken, provides an optimum balance from the full spectrum of polyunsaturated fatty acids including Omega 6 and Omega 3 for maintaining healthy skin and hair coat. In addition, this formula contains a special blend of antioxidant vitamins and minerals to prevent or neutralize the damaging effects of free radicals.

Based on the foregoing, a Terrier dog formulation comprising the following ingredients and analysis was produced: Chicken, Ground Rice, Rolled Oats, Chicken Meal, Cracked Pearled Barley, Natural Flavor, Canola Oil (Preserved with Mixed Tocopherols, Rosemary Extract and Citric Acid), Tomato Pomace, Brewers Dried Yeast, Chicory Root Extract, Potassium Chloride, Bone Phosphate, Vitamins (Choline Chloride, Vitamin A Supplement, Vitamin D₃ Supplement, Vitamin E Supplement, Inositol, Niacin, Ascorbic Acid [Source of Vitamin C], d-Calcium Pantothenate, Thiamine Mononitrate, Riboflavin Supplement, Beta Carotene, Pyridoxine Hydrochloride [Vitamin B₆], Folic Acid, Menadione Sodium Bisulfite Complex [Source of Vitamin K activity], Biotin, Vitamin B₁₂ Supplement), Sodium Chloride, Salmon Oil, Evening Primrose Oil, Minerals (Zinc Oxide, Zinc Proteinate, Ferrous Sulfate, Iron Proteinate, Manganese Oxide, Copper Sulfate, Copper Proteinate, Calcium Iodate, Sodium Selenite), Milk Thistle Powder, Ginkgo Biloba Extract, *Yucca schidigera* Extract, Garlic Powder, Panax Ginseng Root Powder, Chinese Ginseng Root, Spearmint Leaf Powder, Eyebright Powder, Siberian Ginseng Extract, Parsley Seed Oil Powder, Ginger Extract, and Marigold Extract. The analysis of this formulation is provided below.

ANALYSIS

CRUDE PROTEIN	25.0% MINIMUM
CRUDE FAT	12.0% MINIMUM
CRUDE FIBER	4.0% MAXIMUM
MOISTURE	10.0% MAXIMUM

-continued

ANALYSIS	
CALCIUM	1.0% MINIMUM
PHOSPHORUS	0.85% MINIMUM
COPPER	7.5 mg/kg MINIMUM
ZINC	300 mg/kg MINIMUM
OMEGA-6 FATTY ACIDS	3.0%* MINIMUM
OMEGA-3 FATTY ACIDS	0.3%* MINIMUM
GAMMA LINOLENIC ACID	0.03%* MINIMUM

*Not recognized as an essential nutrient by the AAFCO Dog Food Nutrient Profile.

Similarly, animal feeding tests using the procedures of the Association of American Feed Control Officials have shown that NATURE'S RECIPE TERRIER DOGS GROUP SPECIFIC FORMULA provides a complete and balanced nutrition for all stages of life.

The kibble shape of this formulation was again specifically designed based on size, weight, and breed of dogs belonging to this particular group, as were the designated feeding guidelines below. The Terrier diet has a square shape of intermediate size 11.5 mm per side. This shape resembles the square shape of the skull of the Airedale Terrier, Irish Terrier, and Welsh Terrier.

Airedale Terrier	Wife Fox Terrier	Norwich Terrier
American Staffordshire Terrier	Irish Terrier	Scottish Terrier
Australian Terrier	Kerry Blue Terrier	Sealyham Terrier
Bedlington Terrier	Lakeland Terrier	Skye Terrier
Border Terrier	Standard Manchester Terrier	Soft Coated Wheaten Terrier
Bull Terrier	Miniature Bull Terrier	Staffordshire Bull Terrier
Cairn Terrier	Miniature Schnauzer	Welsh Terrier
Dandie Dinmont Terrier	Norfolk Terrier	West Highland White Terrier
Smooth Fox Terrier		

Recommended Feeding Instructions

It is recommended that from weaning to six months of age, the recommended amount be given in three feedings per day. Over six months of age, it is recommended that the amount be reduced to two feedings per day.

Daily Feeding Guidelines

Weight of Dog (lbs.)	Weaning to 6 Months	6-12 Months	Greater Than 12 Months ††
3-10	1½-2½ Cups	¾-1½ Cups	½-1½ Cups
10-15	2½-4 Cups	1½-2½ Cups	1½-1½ Cups
15-25	4-6½ Cups	2½-3½ Cups	1½-2½ Cups
25-50	4½-7½ Cups	3½-5½ Cups	2½-3½ Cups
50-75	7½-9½ Cups	5½-7½ Cups	3½-4½ Cups

Measurements are based on a standard 8 oz. cup which equal approximately 3.5 oz. of dry kibble.

†For gestation and lactation feed as much as 3 times the amount indicated in 3 feedings per day.

††For Cairn and Scottish Terriers feed 15% less than the amount indicated.

EXAMPLE 4

Working Dog Formulation

As discussed supra, the WORKING GROUP breed formulation contains a blend of Canola Oil, Salmon Oil and

Evening Primrose Oil, a source of GLA (gamma linolenic acid), naturally preserved with Tocopherols. This, in combination with Chicken, provides an optimum balance from the full spectrum of polyunsaturated fatty acids including Omega 6 and Omega 3 for maintaining healthy skin and hair coat. In addition, this formula contains a special blend of antioxidant vitamins and minerals to prevent or neutralize the damaging effects of free radicals.

Based on the foregoing, a Working Group Formulation was designed comprising the following ingredients and analysis: Chicken, Ground Rice, Rolled Oats, Chicken Meal, Cracked Pearled Barley, Natural Flavor, Canola Oil (Preserved with Mixed Tocopherols, Rosemary Extract and Citric Acid), Tomato Pomace, Brewers Dried Yeast, Chicory Root Extract, Bone Phosphate, Potassium Chloride, Vitamins (Choline Chloride, Vitamin A Supplement, Vitamin D₃ Supplement, Vitamin E Supplement, Inositol, Niacin, Ascorbic Acid [Source of Vitamin C], d-Calcium Pantothenate, Thiamine Mononitrate, Riboflavin Supplement, Beta Carotene, Pyridoxine Hydrochloride [Vitamin B₆], Folic Acid, Menadione Sodium Bisulfite Complex [Source of Vitamin K activity], Biotin, Vitamin B₁₂ Supplement), Salmon Oil, Evening Primrose Oil, Minerals (Zinc Oxide, Zinc Proteinate, Ferrous Sulfate, Iron Proteinate, Manganese Oxide, Copper Sulfate, Copper Proteinate, Calcium Iodate, Sodium Selenite), Potassium Citrate, Glucosamine Hydrochloride, Hawthorn Berry Powder, Ginkgo Biloba Extract, *Yucca schidigera* Extract, Taurine, Panax Ginseng Root Powder, Chinese Ginseng Root, Spearmint Leaf Powder, Garlic Powder, Eyebright Powder, Siberian Ginseng Extract, Parsley Seed Oil Powder, Ginger Extract, and Marigold Extract. The analysis of this formulation is provided below.

ANALYSIS	
CRUDE PROTEIN	24.0% MINIMUM
CRUDE FAT	13.0% MINIMUM
CRUDE FIBER	4.0% MAXIMUM
MOISTURE	10.0% MAXIMUM
CALCIUM	1.1% MINIMUM
PHOSPHORUS	0.85% MINIMUM
SELENIUM	0.4 mg/kg MINIMUM
TAURINE	0.05% MINIMUM
OMEGA-6 FATTY ACIDS	3.0%* MINIMUM
OMEGA-3 FATTY ACIDS	0.4%* MINIMUM
GAMMA LINOLENIC ACID	0.05%* MINIMUM

*Not recognized as an essential nutrient by the AAFCO Dog Food Nutrient Profile.

Again, animal feeding tests using the procedures of the Association of American Feed Control Officials substantiate that the above NATURE'S RECIPE WORKING DOGS GROUP SPECIFIC FORMULA provides complete and balanced nutrition for all stages of life.

Again, the kibble shape of this formulation was specifically designed based on size, weight, and breed of dogs belonging to this particular group, as were the designated feeding guidelines below. The Working diet is a flattened disc kibble 12 mm in diameter. Being intermediate in size and thickness, it suits the diversity of mouth configurations of this group.

Akita	Great Dane	Portuguese Water Dog
Alaskan Malamute	Great Pyrenees	Rottweiler
Bernese Mountain Dog	Great Swiss Mountain Dog	Saint Bernard

-continued

Boner	Komondor	Samoyed
Bullmastiff	Kuvasz	Siberian Husky
Doberman Pinscher	Mastiff	Standard Schnauzer
Giant Schnauzer	Newfoundland	

Recommended Feeding Instructions

From weaning to six months of age, feed the recommended amount in three feedings per day. Over six months of age, the recommended amount is reduced to two feedings per day.

Daily Feeding Guidelines

Weight of Dog (lbs.)	Weaning to 6 Months	6-12 Months	Greater Than 12 Months †
3-10	1-2½ Cups	¾-1½ Cups	¾-1½ Cups
10-20	2½-3½ Cups	1½-2½ Cups	1½-2 Cups
20-30	3½-5½ Cups	2½-4½ Cups	2-3½ Cups
50-100	6½-10½ Cups	4½-7½ Cups	3½-6 Cups
Over 100		Add ¾ cup for each 10 lbs.	

Measurements are based on a standard 8 oz. cup which equal approximately 3.5 oz. of dry kibble.

†For gestation and lactation feed as much as 3 times the amount indicated in 3 feedings per day.

EXAMPLE 5

Hound Dog Formulation

As discussed supra, the HOUND GROUP breed formulation also contains a blend of Canola Oil, Salmon Oil and Evening Primrose Oil, a source of GLA (gamma linolenic acid), naturally preserved with Tocopherols. This, in combination with Chicken, provides an optimum balance from the full spectrum of polyunsaturated fatty acids including Omega 6 and Omega 3 for maintaining healthy skin and hair coat. In addition, this formula contains a special blend of antioxidant vitamins and minerals to prevent or neutralize the damaging effects of free radicals.

Based on the foregoing, a formulation designed for Hound Dogs comprising the following ingredients and analysis was made: Chicken, Ground Rice, Rolled Oats, Chicken Meal, Cracked Pearl Barley, Natural Flavor, Canola Oil (Preserved with Mixed Tocopherols, Rosemary Extract and Citric Acid), Tomato Pomace, Brewers Dried Yeast, Chicory Root Extract, Bone Phosphate, Potassium Chloride, Vitamins (Choline Chloride, Vitamin A Supplement, Vitamin D₃ Supplement, Vitamin E Supplement, Inositol, Niacin, Ascorbic Acid [Source of Vitamin C], d-Calcium Pantothenate, Thiamine Mononitrate, Riboflavin Supplement, Beta Carotene, Pyridoxine Hydrochloride [Vitamin B₆], Folic Acid, Menadione Sodium Bisulfite Complex [Source of Vitamin K activity], Biotin, Vitamin B₁₂ Supplement), Salmon Oil, Evening Primrose Oil, Minerals (Zinc Oxide, Zinc Proteinate, Ferrous Sulfate, Iron Proteinate, Manganese Oxide, Copper Sulfate, Copper Proteinate, Calcium Iodate, Sodium Selenite), Potassium Citrate, *Lactobacillus acidophilus*, *Enterococcus faecium*, *Bacillus subtilis* Fermentation Extract, *Aspergillus oryzae* Fermentation Extract, *Aspergillus niger* Fermentation Extract, Ginkgo Biloba Extract, *Yucca schidigera* Extract, Garlic Powder, Panax Ginseng Root Powder, Chinese Ginseng Root, Spearmint Leaf Powder, Eyebright Powder, Cranberry Juice Concentrate, Siberian Ginseng Extract, Parsley Seed Oil Powder,

Glutamine, Ginger Extract, Bromelain, and Marigold Extract. The analysis of this formulation is provided below.

ANALYSIS

CRUDE PROTEIN	26.0% MINIMUM
CRUDE FAT	10.0% MINIMUM
CRUDE FIBER	4.0% MAXIMUM
MOISTURE	10.0% MAXIMUM
CALCIUM	1.0% MINIMUM
PHOSPHORUS	0.8% MINIMUM
OMEGA-6 FATTY ACIDS	2.75%* MINIMUM
OMEGA-3 FATTY ACIDS	0.2%* MINIMUM
GAMMA LINOLENIC ACID	0.02%* MINIMUM

*Not recognized as an essential nutrient by the AAFCO Dog Food Nutrient Profile.

Animal feeding tests using the procedures of the Association of American Feed Control Officials substantiate that NATURE'S RECIPE HOUND DOGS GROUP SPECIFIC FORMULA provides a complete and balanced nutrition for all stages of life.

Again, the kibble shape of this formulation was specifically designed based on size, weight, and breed of dogs belonging to this particular group, as were the designated feeding guidelines below. The Hound diet can best be described as an almond or tear drop shape. It has a length at longest point slightly shorter than the Non-Sporting diet. This shape perfectly conforms to breeds of this group such as the Afghan Hound.

Afghan Hound	American Foxhound	Otterhound
Basset Hound	English Foxhound	Petit Basset Griffon
Basset Hound	Greyhound	Veau de
Beagle	Harrier	Pharaoh Hound
Black & Tan Coonhound	Ibizan Hound	Rhodesian Ridgeback
Bloodhound	Irish Wolfhound	Saluki
Borzoi	Norwegian Elkhound	Scottish Deerhound
Dachshund		Whippet

Recommended Feeding Instructions

From weaning to six months of age, feed the recommended amount in three feedings per day. Over six months of age, feed the recommended amount is reduced to two feedings per day.

Daily Feeding Guidelines

Weight of Dog (lbs.)	Weaning to 6 Months	6-12 Months	Greater Than 12 Months †‡
3-10	1½-2½ Cups	¾-1½ Cups	¾-1½ Cups
10-20	2½-4½ Cups	2-3½ Cups	1½-2½ Cups
20-50	4½-7½ Cups	3½-5½ Cups	2½-3½ Cups
50-100	7½-12½ Cups	5½-9½ Cups	3½-6½ Cups
Over 100		Add ¾ cup for each 10 lbs.	

Measurements are based on a standard 8 oz. cup which equal approximately 3.5 oz. of dry kibble.

†For gestation and lactation feed as much as 3 times the amount indicated in 3 feedings per day.

‡For Basset Hounds, Dachshunds and Beagles feed 15% less than the amount indicated.

Herding Dog Formulation

As discussed supra, the HERDING GROUP breed formula contains a blend of Canola Oil, Salmon Oil and Evening Primrose Oil, a source of GLA (gamma linolenic acid), naturally preserved with Tocopherols. This, in combination with Chicken, provides an optimum balance from the full spectrum of polyunsaturated fatty acids including Omega 6 and Omega 3 for maintaining healthy skin and hair coat. In addition, this formula contains a special blend of antioxidant vitamins and minerals to prevent or neutralize the damaging effects of free radicals.

Based on the foregoing, a formulation adapted for Herding Dogs comprising the following ingredients and analysis was made: Chicken, Ground Rice, Rolled Oats, Chicken Meal, Cracked Pearled Barley, Natural Flavor, Canola Oil (Preserved with Mixed Tocopherols, Rosemary Extract and Citric Acid), Tomato Pomace, Brewers Dried Yeast, Chicory Root Extract, Bone Phosphate, Potassium Chloride, Vitamins (Choline Chloride, Vitamin A Supplement, Vitamin D₃ Supplement, Vitamin E Supplement, Inositol, Niacin, Ascorbic Acid [Source of Vitamin C], d-Calcium Pantothenate, Thiamine Mononitrate, Riboflavin Supplement, Beta Carotene, Pyridoxine Hydrochloride [Vitamin B₆], Folic Acid, Menadione Sodium Bisulfite Complex [Source of Vitamin K activity], Biotin, Vitamin B₁₂ Supplement), Salmon Oil, Evening Primrose Oil, Minerals (Zinc Oxide, Zinc Proteinate, Ferrous Sulfate, Iron Proteinate, Manganese Oxide, Copper Sulfate, Copper Proteinate, Calcium Iodate, Sodium Selenite), Potassium Citrate, *Lactobacillus acidophilus*, *Enterococcus faecium*, *Bacillus subtilis* Fermentation Extract, *Aspergillus oryzae* Fermentation Extract, *Aspergillus niger* Fermentation Extract, Glucosamine Hydrochloride, Ginkgo Biloba Extract, *Yucca schidigera* Extract, Panax Ginseng Root Powder, Spearmint Leaf Powder, Eyebright Powder, Siberian Ginseng Extract, Chinese Ginseng Root, Parsley Seed Oil Powder, Ginger Extract, Glutamine, Bromelain, Marigold Extract. The analysis of this specific formulation is provided below.

ANALYSIS	
CRUDE PROTEIN	24.0% MINIMUM
CRUDE FAT	10.0% MINIMUM
CRUDE FIBER	4.0% MAXIMUM
MOISTURE	10.0% MAXIMUM
CALCIUM	1.0% MINIMUM
PHOSPHORUS	0.8% MINIMUM
OMEGA-6 FATTY ACIDS	2.75%* MINIMUM
OMEGA-3 FATTY ACIDS	0.2%* MINIMUM
GAMMA LINOLENIC ACID	0.02%* MINIMUM

*Not recognized as an essential nutrient by the AAFCO Dog Food Nutrient Profile.

Animal feeding tests using the procedures of the Association of American Feed Control Officials substantiate that NATURE'S RECIPE HERDING DOGS GROUP SPECIFIC FORMULA provides a complete and balanced nutrition for all stages of life.

The kibble shape of this formulation was again specifically designed based on size, weight, and breed of dogs belonging to this particular group, as were the designated feeding guidelines below. The Herding diet somewhat resembles the Working diet which relates to the fact that these breeds were at one time in a single group. The Herding

diet has a smaller diameter (10.5 mm vs. 12 mm) but is thicker (8 mm vs. 6 mm) than the Working formula.

Australian Cattle Dog	Border Collie	Old English Sheepdog
Australian Shepherd	Bouvier Des Flandres	Puli
Bearded Collie	Briard	Shetland Sheepdog
Belgian Malinois	Canaan	Cardigan Welsh Corgi
Belgian Sheepdog	Collie	Pembroke Welsh Corgi
Belgian Tervueren	German Shepherd Dog	

Recommended Feeding Guidelines

From weaning to six months of age, feed the recommended amount in three feedings per day. Over six months of age, the recommended amount is reduced to two feedings per day.

Daily Feeding Guidelines

Weight of Dog (lbs.)	Weaning to 6 Months	6-12 Months	Greater than 12 Months ††
3-10	1-2½ Cups	¾-1½ Cups	¾-1½ Cups
10-20	2½-3½ Cups	1½-2½ Cups	1½-2 Cups
20-50	3½-4½ Cups	2½-4½ Cups	2-3½ Cups
50-100	6½-10½ Cups	4½-7½ Cups	3½ Cups-6 Cups
Over 100			Add ½ cup for each 10 lbs.

Measurements are based on a standard 8 oz. cup which equal approximately 3.5 oz. of dry kibble.

† For gestation and lactation feed as much as 3 times the amount indicated in 3 feedings per day.

†† For Collies and Shetland Sheepdogs feed 15% less than the amount indicated.

EXAMPLE 7

Sporting Dog Formulation

As discussed supra, the SPORTING GROUP breed formula contains a blend of Canola Oil, Salmon Oil and Evening Primrose Oil, a source of GLA (gamma linolenic acid), naturally preserved with Tocopherols. This, in combination with Chicken, provides an optimum balance from the full spectrum of polyunsaturated fatty acids including Omega 6 and Omega 3 for maintaining healthy skin and hair coat. In addition, this formula contains a special blend of antioxidant vitamins and minerals to prevent or neutralize the damaging effects of free radicals.

Based on the foregoing, a formulation designed for Sport Group Dogs comprising the following ingredients and analysis was produced: Chicken, Ground Rice, Chicken Meal, Natural Flavor, Canola Oil (Preserved with Mixed Tocopherols, Rosemary Extract and Citric Acid), Tomato Pomace, Brewers Dried Yeast, Chicory Root Extract, Potassium Chloride, Sodium Bicarbonate, Vitamins (Choline Chloride, Vitamin A Supplement, Vitamin D₃ Supplement, Vitamin E Supplement, Inositol, Niacin, Ascorbic Acid [Source of Vitamin C], d-Calcium Pantothenate, Thiamine Mononitrate, Riboflavin Supplement, Beta Carotene, Pyridoxine Hydrochloride [Vitamin B₆], Folic Acid, Menadione Sodium Bisulfite Complex [Source of Vitamin K activity], Biotin, Vitamin B₁₂ Supplement), Salmon Oil, Evening Primrose Oil, Minerals (Zinc Oxide, Zinc Proteinate, Ferrous Sulfate, Iron Proteinate, Manganese Oxide, Copper Sulfate, Copper Proteinate, Calcium Iodate, Sodium Selenite), Glucosamine Hydrochloride, Hawthorn Berry

Powder, Ginkgo Biloba Extract, *Yucca schidigera* Extract, Taurine, Panax Ginseng Root Powder, Chinese Ginseng Root, Spearmint Leaf Powder, Eyebright Powder, Siberian Ginseng Extract, Parsley Seed Oil Powder, Ginger Extract, Glutamine, and Marigold Extract. The analysis of this formulation is provided below.

ANALYSIS

CRUDE PROTEIN	25.0% MINIMUM
CRUDE FAT	15.0% MINIMUM
CRUDE FIBER	3.0% MAXIMUM
MOISTURE	10.0% MAXIMUM
CALCIUM	1.0% MAXIMUM
PHOSPHORUS	0.8% MINIMUM
SODIUM	0.40% MINIMUM
TAURINE	0.05% MINIMUM
OMEGA-6 FATTY ACIDS	30.5% MINIMUM
OMEGA-3 FATTY ACIDS	0.4% MINIMUM
GAMMA LINOLENIC ACID	0.025% MINIMUM

*Not recognized as an essential nutrient by the AAFCO Dog Food Nutrient Profile.

Animal feeding tests using the procedures of the Association of American Feed Control Officials also indicate that the above NATURE'S RECIPE SPORTING DOGS GROUP SPECIFIC FORMULA provides a complete and balanced nutrition for all stages of life.

The kibble shape of this formulation was again specifically designed based on size, weight, and breed of dogs belonging to this particular group, as were the designated feeding guidelines below. The Sporting Diet has a unique triangle shape, well suited to the prevalence of pointed jaws of the breeds in this group.

Brittany	Labrador Retriever	English Springer Spaniel
Pointer	English Setter	Field Spaniel
German Shorthaired Pointer	Gordon Setter	Irish Water Spaniel
German Wirehaired Pointer	Irish Setter	Sussex Spaniel
Chesapeake Bay Retriever	American Water Spaniel	Welsh Springer Spaniel
Curly-Coated Retriever	Cocker Spaniel	Vizsla
Flat-Coated Retriever	Cocker Spaniel	Weimaraner
Golden Retriever	English Cocker Spaniel	Wirehaired Pointing Griffon

Recommended Feeding Guidelines

From weaning to six months of age, feed the recommended amount in three feedings per day. Over six months of age, the recommended feeding amount is reduced to two feedings per day.

Daily Feeding Guidelines

Weight of Dog (lbs.)	Weaning to 6 Months	6-12 Months	Greater Than 12 Months ††
3-10	1/4-1 1/4 Cups	1/4-1 1/4 Cups	1/4-1 1/4 Cups
10-20	1 1/4-3 Cups	1 1/4-2 1/4 Cups	1 1/4-3 Cups
20-50	3-5 1/2 Cups	2 1/4-4 1/4 Cups	1 1/4-3 1/4 Cups

-continued

Daily Feeding Guidelines

Weight of Dog (lbs.)	Weaning to 6 Months	6-12 Months	Greater Than 12 Months ††
50-100	5 1/2-9 Cups	4 1/4-6 1/4 Cups	3 1/4-5 1/4 Cups
Over 100			Add 1/2 cup for each 10 lbs.

Measurements are based on a standard 8 oz. cup which equal approximately 3.5 oz. of dry kibble.

† For gestation and lactation feed as much as 3 times the amount indicated in 3 feedings per day.

‡ For Labrador Retriever and Cocker Spaniels feed 15% less than the amount indicated.

What is claimed is:

1. A pet food formulation which is adapted for non-sporting dogs that comprises the following ingredients: Chicken, Ground Rice, Rolled Oats, Chicken Meal, Cracked Pearled Barley, Natural Flavor, Canola Oil Preserved with Mixed Tocopherols, Rosemary Extract and Citric Acid, Bone Phosphate, Tomato Pomace, Brewers Dried Yeast, Sodium Hexametaphosphate, Chicory Root Extract, Potassium Chloride, Vitamins comprising Choline Chloride, Vitamin A Supplement, Vitamin D₃ Supplement, Vitamin E Supplement, Inositol, Niacin, Ascorbic Acid or a Source of Vitamin C, d-Calcium Pantothenate, Thiamine Mononitrate, Riboflavin Supplement, Beta Carotene, Pyridoxine Hydrochloride or Vitamin B₆, Folic Acid, Menadione Sodium Bisulfite Complex or a Source of Vitamin K activity, Biotin, and Vitamin B₁₂ Supplement, Sodium Chloride, Salmon Oil, Evening Primrose Oil, Minerals comprising Zinc Oxide, Zinc Proteinate, Ferrous Sulfate, Iron Proteinate, Manganese Oxide, Copper Sulfate, Copper Proteinate, Calcium Iodate, and Sodium Selenite, Potassium Citrate, Ginkgo Biloba Extract, *Yucca schidigera* Extract, Garlic Powder, Panax Ginseng Root Powder, Chinese Ginseng Root, Spearmint Leaf Powder, Eyebright Powder, Siberian Ginseng Extract, Parsley Seed Oil Powder, Ginger Extract, Bromelain, and Marigold Extract.

2. A pet food formulation which is adapted for toy dogs that comprises the following ingredients: Chicken, Ground Rice, Rolled Oats, Chicken Meal, Cracked Pearled Barley, Natural Flavor, Canola Oil Preserved with Mixed Tocopherols, Rosemary Extract and Citric Acid, Tomato Pomace, Brewers Dried Yeast, Bone Phosphate, Chicory Root Extract, Potassium Chloride, Sodium Bicarbonate, Vitamins comprising Choline Chloride, Thiamine A Supplement, Vitamin D₃ Supplement, Vitamin E Supplement, Inositol, Niacin, Ascorbic Acid or a Source of Vitamin C, d-Calcium Pantothenate, Thiamine Mononitrate, Riboflavin Supplement, Beta Carotene, Pyridoxine Hydrochloride or Vitamin B₆, Folic Acid, Menadione Sodium Bisulfite Complex or a Source of Vitamin K activity, Biotin, and Vitamin B₁₂ Supplement, Salmon Oil, Evening Primrose Oil, Minerals comprising Zinc Oxide, Zinc Proteinate, Ferrous Sulfate, Iron Proteinate, Manganese Oxide, Copper Sulfate, Copper Proteinate, Calcium Iodate, and Sodium Selenite, Ginkgo Biloba Extract, *Yucca schidigera* Extract, Garlic Powder, Panax Ginseng Root Powder, Chinese Ginseng Root, Spearmint Leaf Powder, Eyebright Powder, Cranberry Juice Concentrate, Siberian Ginseng Extract, Parsley Seed Oil Powder, Ginger Extract, and Marigold Extract.

3. A pet food formulation which is adapted for terrier dogs that comprises the following ingredients: Chicken, Ground Rice, Rolled Oats, Chicken Meal, Cracked Pearled Barley,

Natural Flavor, Canola Oil Preserved with Mixed Tocopherols, Rosemary Extract and Citric Acid, Tomato Pomace, Brewers Dried Yeast, Chicory Root Extract, Potassium Chloride, Bone Phosphate, Vitamins comprising Choline Chloride, Vitamin A Supplement, Vitamin D₃ Supplement, Vitamin E Supplement, Inositol, Niacin, Ascorbic Acid or a Source of Vitamin C, d-Calcium Pantothenate, Thiamine Mononitrate, Riboflavin Supplement, Beta Carotene, Pyridoxine Hydrochloride or Vitamin B₆, Folic Acid, Menadione Sodium Bisulfite Complex or a Source of Vitamin K activity, and Biotin, and Vitamin B₁₂ Supplement, Sodium Chloride, Salmon Oil, Evening Primrose Oil, Minerals comprising Zinc Oxide, Zinc Proteinate, Ferrous Sulfate, Iron Proteinate, Manganous Oxide, Copper Sulfate, Copper Proteinate, Calcium Iodate, and Sodium Selenite, Milk Thistle Powder, Ginkgo Biloba Extract, *Yucca schidigera* Extract, Garlic Powder, Panax Ginseng Root Powder, Chinese Ginseng Root, Spearmint Leaf Powder, Eyebright Powder, Siberian Ginseng Extract, Parsley Seed Oil Powder, Ginger Extract, and Marigold Extract.

4. A pet food formulation which is adapted for working dogs that comprises the following ingredients: Chicken, Ground Rice, Rolled Oats, Chicken Meal, Cracked Pearled Barley, Natural Flavor, Canola Oil Preserved with Mixed Tocopherols, Rosemary Extract and Citric Acid, Tomato Pomace, Brewers Dried Yeast, Chicory Root Extract, Bone Phosphate, Potassium Chloride, Vitamins comprising Choline Chloride, Vitamin A Supplement, Vitamin D₃ Supplement, Vitamin E Supplement, Inositol, Niacin, Ascorbic Acid or a Source of Vitamin C, d-Calcium Pantothenate, Thiamine Mononitrate, Riboflavin Supplement, Beta Carotene, Pyridoxine Hydrochloride or Vitamin B₆, Folic Acid, Menadione Sodium Bisulfite Complex or a Source of Vitamin K activity, and Biotin, Vitamin B₁₂ Supplement, Salmon Oil, Evening Primrose Oil, Minerals comprising Zinc Oxide, Zinc Proteinate, Ferrous Sulfate, Iron Proteinate, Manganous Oxide, Copper Sulfate, Copper Proteinate, Calcium Iodate, and Sodium Selenite, Potassium Citrate, Glucosamine Hydrochloride, Hawthorn Berry Powder, Ginkgo Biloba Extract, *Yucca schidigera* Extract, Taurine, Panax Ginseng Root Powder, Chinese Ginseng Root, Spearmint Leaf Powder, Garlic Powder, Eyebright Powder, Siberian Ginseng Extract, Parsley Seed Oil Powder, Ginger Extract, and Marigold Extract.

5. A pet food formulation which is adapted for hound dogs that comprises the following ingredients: Chicken, Ground Rice, Rolled Oats, Chicken Meal, Cracked Pearled Barley, Natural Flavor, Canola Oil Preserved with Mixed Tocopherols, Rosemary Extract and Citric Acid, Tomato Pomace, Brewers Dried Yeast, Chicory Root Extract, Bone Phosphate, Potassium Chloride, Vitamins comprising Choline Chloride, Vitamin A Supplement, Vitamin D₃ Supplement, Vitamin E Supplement, Inositol, Niacin, Ascorbic Acid or a Source of Vitamin C, d-Calcium Pantothenate, Thiamine Mononitrate, Riboflavin Supplement, Beta Carotene, Pyridoxine Hydrochloride or Vitamin B₆, Folic Acid, Menadione Sodium Bisulfite Complex or a Source of Vitamin K activity, and Biotin, Vitamin B₁₂ Supplement, Salmon Oil, Evening Primrose Oil, Minerals comprising Zinc Oxide, Zinc Proteinate, Ferrous Sulfate, Iron Proteinate, Manganous Oxide, Copper Sulfate, Copper Proteinate, Calcium Iodate, and Sodium Selenite, Potassium

Citrate, *Lactobacillus acidophilus*, *Enterococcus faecium*, *Bacillus subtilis* Fermentation Extract, *Aspergillus oryzae* Fermentation Extract, *Aspergillus niger* Fermentation Extract, Ginkgo Biloba Extract, *Yucca schidigera* Extract, Garlic Powder, Panax Ginseng Root Powder, Chinese Ginseng Root, Spearmint Leaf Powder, Eyebright Powder, Cranberry Juice Concentrate, Siberian Ginseng Extract, Parsley Seed Oil Powder, Glutamine, Ginger Extract, Bromelain, and Marigold Extract.

6. A pet food formulation which is adapted for herding dogs that comprises the following ingredients: Chicken, Ground Rice, Rolled Oats, Chicken Meal, Cracked Pearled Barley, Natural Flavor, Canola Oil Preserved with Mixed Tocopherols, Rosemary Extract and Citric Acid, Tomato Pomace, Brewers Dried Yeast, Chicory Root Extract, Bone Phosphate, Potassium Chloride, Vitamins comprising Choline Chloride, Vitamin A Supplement, Vitamin D₃ Supplement, Vitamin E Supplement, Inositol, Niacin, Ascorbic Acid or a Source of Vitamin C, d-Calcium Pantothenate, Thiamine Mononitrate, Riboflavin Supplement, Beta Carotene, Pyridoxine Hydrochloride or Vitamin B₆, Folic Acid, Menadione Sodium Bisulfite Complex or a Source of Vitamin K activity, and Biotin, Vitamin B₁₂ Supplement, Salmon Oil, Evening Primrose Oil, Minerals comprising Zinc Oxide, Zinc Proteinate, Ferrous Sulfate, Iron Proteinate, Calcium Iodate, and Sodium Selenite, Potassium Citrate, *Lactobacillus acidophilus*, *Enterococcus faecium*, *Bacillus subtilis* Fermentation Extract, *Aspergillus oryzae* Fermentation Extract, *Aspergillus niger* Fermentation Extract, Glucosamine Hydrochloride, Ginkgo Biloba Extract, *Yucca schidigera* Extract, Panax Ginseng Root Powder, Spearmint Leaf Powder, Eyebright Powder, Siberian Ginseng Extract, Chinese Ginseng Root, Parsley Seed Oil Powder, Ginger Extract, Glutamine, Bromelain, and Marigold Extract.

7. A pet food formulation that is adapted for sporting dogs that comprises the following ingredients: Chicken, Ground Rice, Chicken Meal, Natural Flavor, Canola Oil Preserved with Mixed Tocopherols, Rosemary Extract and Citric Acid, Tomato Pomace, Brewers Dried Yeast, Chicory Root Extract, Potassium Chloride, Sodium Bicarbonate, Vitamins comprising Choline Chloride, Vitamin A Supplement, Vitamin D₃ Supplement, Vitamin E Supplement, Inositol, Niacin, Ascorbic Acid or a Source of Vitamin C, d-Calcium Pantothenate, Thiamine Mononitrate, Riboflavin Supplement, Beta Carotene, Pyridoxine Hydrochloride or Vitamin B₆, Folic Acid, Menadione Sodium Bisulfite Complex or a Source of Vitamin K activity, and Biotin, Vitamin B₁₂ Supplement, Salmon Oil, Evening Primrose Oil, Minerals comprising Zinc Oxide, Zinc Proteinate, Ferrous Sulfate, Iron Proteinate, Manganous Oxide, Copper Sulfate, Copper Proteinate, Calcium Iodate, and Sodium Selenite, Glucosamine Hydrochloride, Hawthorn Berry Powder, Ginkgo Biloba Extract, *Yucca schidigera* Extract, Taurine, Panax Ginseng Root Powder, Chinese Ginseng Root, Spearmint Leaf Powder, Eyebright Powder, Siberian Ginseng Extract, Parsley Seed Oil Powder, Ginger Extract, Glutamine, and Marigold Extract.

* * * * *

Exhibit D



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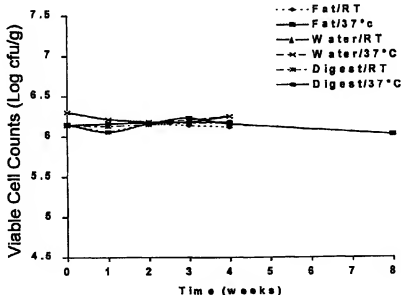
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(54) Cereal product containing probiotics

(57) A dried, ready-to-eat cereal product comprising a gelatinised starch matrix which includes a coating or filling which contains a probiotic micro-organism. The cereal product may be in the form of a pet food, a break-fast cereal, an infant cereal or a convenience food. The cereal product may be produced by cooking a starch

source to form a gelatinised starch matrix; forming the gelatinised matrix into pieces; drying the pieces; and coating or filling the pieces with a carrier which contains probiotic micro-organisms.

FIG.1.



Description

Field of the Invention

This invention relates to a ready-to-eat cereal product which contains a probiotic micro-organism; for example pet foods, breakfast cereals, infant cereals or convenience foods. In use, the cereal product has a beneficial effect in the gastro-intestinal tract of the person or animal consuming it and hence upon the person or animal. The invention also relates to a process of producing the cereal product and to methods of promoting beneficial effects in the gastro-intestinal tracts of humans and animals.

Background of the invention

Probiotic micro-organisms are micro-organisms which beneficially affect a host by improving its intestinal microbial balance (Fuller, R; 1989; *J. Applied Bacteriology*, 66: 365-378). In general, probiotic micro-organisms produce organic acids such as lactic acid and acetic acid which inhibit the growth of pathogenic bacteria such as *Clostridium perfringens* and *Helicobacter pylori*. Consequently, probiotic bacteria are believed to be useful in the treatment and prevention of conditions caused by pathogenic bacteria. Further, probiotic micro-organisms are believed to inhibit the growth and activity of putrefying bacteria and hence the production of toxic amine compounds. It is also believed that probiotic bacteria activate the immune function of the host.

Therefore there is considerable interest in including probiotic micro-organisms into foodstuffs. For example, many fermented milk products which contain probiotic micro-organisms are commercially available. Usually these products are in the form of yoghurts and an example is the LC1[®] yoghurt (Société des Produits Nestlé SA). Several infant and follow-up formulas which contain probiotic micro-organisms are also commercially available; for example the BIO NAN[®] formula (Société des Produits Nestlé SA).

Similarly, for animals, there has been interest in including probiotic micro-organisms into animal feeds. For example, Russian patent 2018313 discloses a powdered, spray-dried animal feed which is based upon milk and which contains certain bifidobacteria and streptococci. The animal feed is aimed primarily at live stock although it is mentioned that the feed may be fed to pets.

However, there are two main issues in incorporating probiotic micro-organisms into foodstuffs. First, the foodstuff must be in a form which is palatable to a consumer. Secondly, the probiotic micro-organism must remain viable during storage. The second issue is particularly problematic for ready-to-eat cereal products. These cereal products, unlike fermented milks, are required to have long storage lives; for example at least a year while the cell counts for many probiotic micro-organisms may fall away completely within one or two days. This is particularly the case if the water activity of the foodstuff is above about 0.5. This is usually the case for dried pet foods.

Therefore there is a need for a ready-to-eat cereal product which contains a probiotic micro-organism, is highly palatable, and which is storage stable.

Summary of the Invention

Accordingly, in one aspect, this invention provides a dried, ready-to-eat cereal product comprising a gelatinised starch matrix which includes a coating or filling containing a probiotic micro-organism.

It has been found that probiotic micro-organisms remain viable for extended periods of time when formulated into a coating on or filling in a dried cereal product. This is surprising since probiotic micro-organisms ordinarily die off rapidly. This is particularly the case for dried, cooked pet foods which generally have a water activity of above about 0.5; levels at which probiotic micro-organisms ordinarily die off rapidly. Therefore the invention offers the advantage of a ready-to-eat cereal product which is highly palatable and which contains a shelf stable source of probiotic micro-organisms.

The cereal product may be in the form of a dried pet food, breakfast cereal, an infant cereal, or a convenience food such as a cereal bar. For human foods, the gelatinised starch matrix is preferably in flaked or expanded form. For pet foods, the gelatinised starch matrix is preferably in the form of pieces or pellets. The gelatinised matrix is preferably produced by extrusion cooking a starch source.

Preferably the coating comprises a carrier substrate which carries the probiotic micro-organism in it. The filling may also comprise a carrier substrate which carries the probiotic micro-organism in it. For example, the carrier substrate may be protein digest, fat, milk solids, sugar or a particulate flavouring agent.

In a further aspect, this invention provides a process of preparing a dried, ready-to-eat cereal product, the process comprising cooking a starch source to form a gelatinised starch matrix; forming the gelatinised starch matrix into pieces and drying the pieces; and coating or filling the pieces with a substrate which contains probiotic micro-organisms.

In one embodiment, the gelatinised starch matrix is formed into pieces and dried by extruding the gelatinised matrix

to form a cooked extrudate and cutting and drying the cooked extrudate to form dried pieces. The gelatinised matrix may be caused to expand upon extrusion to form, after cutting and drying, expanded pieces. Alternatively, the pieces may be subjected to flaking to form flaked pieces.

In another embodiment, the gelatinised starch matrix may be formed into pieces and dried by roller-drying the gelatinised starch matrix to form flakes.

In a further embodiment, the gelatinised starch matrix may be formed into pieces and dried by extruding the gelatinised matrix to form a cooked extrudate containing an aperture; and cutting and drying the pieces. Preferably the gelatinised starch matrix is extruded with a central bore for receiving a filling.

Brief Description of the Drawings

Embodiments of the invention are now described, by way of example only, with reference to the drawings in which:

Figure 1 is a graph illustrating the viability of *Bacillus coagulans* in various coatings on a dried, cooked, pet food; and

Figure 2 is a graph illustrating the viability of *Bacillus subtilis* in various coatings on a dried, cooked, pet food.

Detailed description of preferred embodiments of the invention

Embodiments of the invention are now described, by way of example only. The invention provides a dried, ready-to-eat cereal product in the form of a gelatinised starch matrix which includes a coating or filling. The coating or filling contains a probiotic micro-organism. The probiotic micro-organism may be selected from one or more micro-organisms suitable for human or animal consumption and which is able to improve the microbial balance in the human or animal intestine.

Examples of suitable probiotic micro-organisms include yeasts such as *Saccharomyces*, *Debaromyces*, *Candida*, *Pichia* and *Torulopsis*, moulds such as *Aspergillus*, *Rhizopus*, *Mucor*, and *Penicillium* and *Torulopsis* and bacteria such as the genera *Bifidobacterium*, *Bacteroides*, *Clostridium*, *Fusobacterium*, *Melissococcus*, *Propionibacterium*, *Streptococcus*, *Enterococcus*, *Lactococcus*, *Staphylococcus*, *Peptostreptococcus*, *Bacillus*, *Pediococcus*, *Micrococcus*, *Leuconostoc*, *Weissella*, *Aerococcus*, *Oenococcus* and *Lactobacillus*. Specific examples of suitable probiotic micro-organisms are: *Saccharomyces cerevisiae*, *Bacillus coagulans*, *Bacillus licheniformis*, *Bacillus subtilis*, *Bifidobacterium bifidum*, *Bifidobacterium infantis*, *Bifidobacterium longum*, *Enterococcus faecium*, *Enterococcus faecalis*, *Lactobacillus acidophilus*, *Lactobacillus alimentarius*, *Lactobacillus casei* subsp. *casei*, *Lactobacillus casei* Shirota, *Lactobacillus curvatus*, *Lactobacillus delbrueckii* subsp. *lactis*, *Lactobacillus farciminus*, *Lactobacillus gasseri*, *Lactobacillus helveticus*, *Lactobacillus johnsonii*, *Lactobacillus reuteri*, *Lactobacillus rhamnosus* (*Lactobacillus GG*), *Lactobacillus sake*, *Lactococcus lactis*, *Micrococcus varians*, *Pediococcus acidilactici*, *Pediococcus pentosaceus*, *Pediococcus acidilactici*, *Pediococcus halophilus*, *Streptococcus faecalis*, *Streptococcus thermophilus*, *Staphylococcus carnosus*, and *Staphylococcus xylosus*. The probiotic micro-organisms are preferably in powdered, dried form; especially in spore form for micro-organisms which form spores. Further, if desired, the probiotic micro-organism may be encapsulated to further increase the probability of survival; for example in a sugar matrix, fat matrix or polysaccharide matrix.

The dried, ready-to-eat cereal product may be produced from any suitable ingredients; such as those commonly used in dried, ready-to-eat cereal products. One of these ingredients is a starch source. Suitable starch sources are, for example, grain flours such as corn, rice, wheat, barley, soy and oats. Also mixtures of these flours may be used. The flours may be whole flours or may be flours which have had fractions removed; for example the germ fraction or husk fraction may be removed. Rice flour, corn flour and wheat flour are particularly suitable; either alone or in combination. The starch source will be chosen largely on the basis of the nutritional value, palatability considerations, and the type of cereal product desired.

The cereal product may also contain a starch source. Suitable protein sources may be selected from any suitable animal or vegetable protein source; for example meat meal, bone meal, fish meal, soy protein concentrates, milk proteins, gluten, and the like. The choice of the protein source will be largely determined by the nutritional needs, palatability considerations, and the type of cereal product produced. Of course, the starch source may also be a source of protein.

The cereal product may be produced in many different ways as desired. However, an especially suitable way of producing the cereal product is by extrusion cooking. This may be done as is well known in the art. For example, in one suitable process, a feed mixture is fed into a preconditioner. The feed mixture is primarily made up of the starch source and other ingredients such as sugar, salt, spices, seasonings, vitamins, minerals, flavouring agents, colouring agents, antioxidants, protein sources, fats and the like. If desired, sources of insoluble fibre may also be included; for example wheat bran, corn bran, rice bran, rye bran and the like. Further, if desired, a source of soluble fibre may be included, for

example, chicory fibres, inulin, flucotooligosaccharides, soy oligosaccharides, oat bran concentrate, guar gum, carob bean gum, xanthan gum, and the like. Preferably the soluble fibre selected is a substrate for the micro-organism selected, or such that the soluble fibre and micro-organism form a symbiotic relationship for promoting beneficial effects. The maximum level of soluble fibre is preferably about 20% by weight; especially about 10% by weight. For example, for pet foods, chicory may be included to comprise about 1% to about 20% by weight of the feed mixture; more preferably about 2% to about 10% by weight.

Depending upon the desired form of the cereal product, the starch content of the feed mixture may be varied. For example, for an expanded cereal product, the feed mixture preferably includes up to about 40% by weight of starch. However, for a flaked product, it is not necessary to use large amounts of starch in the feed mixture since it is possible to flake an unexpanded product.

In the preconditioner, water or steam, or both, is mixed into the feed mixture. Sufficient water or steam is mixed into the feed mixture to moisten the feed mixture. If desired, the temperature of the feed mixture may be raised in the preconditioner to about 60°C to about 90°C by weight. A suitable preconditioner is described in US patent 4,752,139. It is not necessary to subject the feed mixture to preconditioning but it is advantageous to do so.

The moistened feed leaving the preconditioner is then fed into an extruder. The extruder may be any suitable single or twin screw, cooking-extruder. Suitable extruders may be obtained from Wenger Manufacturing Inc, Cletral SA, Bühler AG, and the like. During passage through the extruder, the moistened feed passes through a cooking zone, in which it is subjected to mechanical shear and is heated; for example up to a maximum temperature of up to about 150°C, and a forming zone. The gauge pressure in the forming zone is about 800 kPa to about 10 MPa, as desired. If desired, water or steam, or both, may be introduced into the cooking zone. During passage through the extruder, the starch source of the moistened feed is gelatinised to provide a gelatinised starch matrix.

If desired, a small amount of an edible oil may be fed into the extruder along with the moistened feed to facilitate the extrusion process or as a carrier for oil soluble additives. Any suitable oil may be used; for example vegetable oils such as sunflower oil, safflower oil, corn oil, and the like. If oils are used, oils which are high in mono-unsaturates are particularly preferred. Hydrogenated oils or fats are also preferred. The amount of oil used is preferably kept below about 1% by weight.

The gelatinised matrix leaving the extruder is forced through a suitable die; for example a die as described in European patent application 0665051; the disclosure of which is incorporated by reference. A shaped extrudate, which has a cross-sectional shape corresponding to that of the orifice of the die, leaves the die. If it is desired to produce a centred-filled cereal product, the gelatinised matrix may be extruded with a central bore. The shaped extrudate is then cut into pieces using rotating blades at the exit of the die. Depending upon the conditions in the extruder and the composition of the shaped extrudate, the shaped extrudate expands to a greater or lesser extent. In the case of pet foods, little or no expansion usually takes place.

If a flaked product is to be produced, the pieces may then be transferred to a flaking apparatus. Suitable apparatus are well known and widely used in the cereal industry and may be purchased from, for example, Bühler AG in Switzerland. If desired, the pieces may be partially dried before flaking.

The pieces are then dried to a moisture content below about 10% by weight. This is conveniently carried out in a hot air drier as is conventional. For breakfast cereals, moisture contents of about 1% to about 3% by weight are preferred.

The pieces intended for pet foods may be in the form of chewable pieces. The pieces usually have a water activity of about 0.5 to about 0.7.

The expanded pieces intended for human foods have a crispy, pleasant texture and good organoleptic properties. The flaked pieces also have good texture and organoleptic properties. The pieces have a pleasant taste of toasted cereal. Conveniently, the density of the pieces may be less than about 300 g/l. At this point, the expanded or flaked pieces usually have a water activity of about 0.15 to about 0.3.

The probiotic micro-organisms are then mixed into a suitable carrier substrate. The carrier substrate will vary depending on whether the pieces are intended for animals or humans. For pet foods, suitable carrier substrates include animal fats such as tallow, vegetable fats such as hydrogenated soy fat, protein digests which are commonly used as flavour coatings, and water. For human foods, suitable carrier substrates include liquids, such as fats and sugar solutions, and particulate coatings such as particulate flavour coatings. Suitable fats are edible vegetable oils and fats; for example hydrogenated soy fat. Suitable particulate flavour coatings include sugars, chocolate powders, milk powders, malted powders, flavoured beverage powders, and the like. If desired, the probiotic micro-organisms may be encapsulated.

Protection agents to improve the survival of the micro-organisms may be incorporated into the carrier substrate. Examples of suitable protecting agents are vitamins such as vitamins C and E, amino acids and their salts such as lysine, glycine, cysteine and sodium glutamate, sugars such as lactose, trehalose, saccharose, dextrose and maltodextrine, and proteins such as milk and soya proteins. Trace elements and minerals may also be included in the carrier substrate.

The selection of the carrier substrate will depend upon factors such as palatability considerations and the survival of the probiotic micro-organism since some micro-organisms survive better in some carrier substrates than others. For example, it is found that *S. cerevisiae* may be slightly less stable in protein digests than in fats. If fats are used in the carrier substrate, the carrier substrate preferably contains antioxidants to reduce the action of oxygen on sensitive micro-organisms. However selecting the optimum carrier substrate is a matter of simple trial and error for the skilled person. If necessary, the carrier substrate may be heated slightly to melt it or to reduce its viscosity.

To produce a coated cereal product, any technique suitable for coating the pieces may be used. For example, in the case of a liquid carrier substrate, the mixture of the probiotic micro-organism and the carrier substrate may be sprayed onto the dried pieces. This may be carried out in any suitable manner. For example, the pieces may be fed into a fluidised bed onto which the mixture is sprayed. Alternatively, the pieces may be fed into a rotary coater into which the mixture is sprayed. As a further alternative, the pieces may be caused to fall in a curtain and the coating mixture sprayed onto the curtain. In the case of a particulate carrier substrate, the probiotic micro-organism and the carrier substrate may be mixed to form a dry mix. Heat sensitive components such as vitamins, amino acids, etc may also be included in the dry mix. The dry mix is then agglomerated on the dried pieces using an agglomerating agent. A suitable procedure is described in US patent 4,777,056; the disclosure of which is incorporated by reference. Fats, oils and sugar solutions are examples of suitable agglomerating agents. Particulate carrier substrates may also be dusted onto the cereal product.

For a filled cereal product, the mixture of the probiotic and micro-organism and carrier substrate is filled into the central bore of each piece. In this case, the carrier substrate is preferably viscous or a substance which hardens rapidly. Fats are particularly suitable. Alternatively the cereal product and carrier substrate may be fed into a tumbler and the carrier substrate agglomerated to the cereal product using a syrup. In this case, the cereal product is coated and filled.

The dried, ready-to-eat cereal product conveniently contains about 10^4 to about 10^{10} cells of the probiotic micro-organism per gram of the dried cereal product; preferably about 10^6 to about 10^8 cells of the probiotic micro-organism per gram. The dried cereal product may contain about 0.5% to about 20% by weight of the mixture of the probiotic micro-organism and carrier substrate; preferably about 1% to about 6% by weight; for example about 3% to about 5% by weight.

The dried cereal product may then be further processed as desired. For example, if the dried cereal is to be used as a breakfast cereal, dried fruit, nuts, other cereals, dried milk produce (such as dried yoghurt etc) may be dry mixed with or agglomerated with the coated cereal. If desired, the dried cereal may be further coated with protective agents or flavouring agents, or both. This may also be carried out prior to or during coating or filling of the dried pieces with the mixture of the probiotic and micro-organism and carrier substrate.

It is also possible to produce a dried cereal product by mixing together water and the ingredients of cereal product; for example in a preconditioner. The wet mixture may then be shaped into a desired shape; for example using shaping rollers. The shaped mixture may then be baked in an oven; for example at about 220°C to about 280°C for about 10 minutes to about 1 hour. The dried cereal product has the appearance of a baked biscuit. The coating or filling may then be applied as discussed above.

Alternatively the cereal product may be formulated into convenience foods such as snack bars and the like. Again the cereal product may be mixed with nuts, dried fruit, sugars or other sweeteners, colouring agents, or flavouring agents, and the like. A suitable binder, for example arabic gum or gelatine, may then be added. An agent which reduces breakability of the bar may also be included; for example hydrolysed wheat. If desired, the bar may be coated with a suitable coating; for example chocolate. Processes for manufacturing snack bars are well known and are described in the art; see for example US patent 4,871,557.

It will be appreciated that the dried, ready-to-eat cereal product may be produced by any suitable process and not only that described above.

In the case of human foods, the dried, ready-to-eat cereal product preferably comprises a nutritional supplement. In the case of pet foods, the dried, ready-to-eat cereal product may be fed to pets as a sole source of nutrition or may be supplemented by other sources of nutrition; for example canned food. When consumed in adequate amounts, the dried, ready-to-eat cereal product results in a production of acids, such as lactic acid and acetic acid, in the gut of the human or animal. This inhibits the growth of pathogenic bacteria such as *Clostridium perfringens* or those which adversely affect well being, and has a beneficial effect on the human or animal. Also, the probiotic micro-organisms adhere to intestinal surfaces and compete with undesired bacteria. Further, the growth and activity of putrefying bacteria may be inhibited and hence the production of toxic amine compounds. Adequate amounts of the dried, ready-to-eat cereal product may also result in the activation of the immune function of the human or animal.

The amount of the dried, ready-to-eat cereal product to be consumed by the human or animal to obtain a beneficial effect will depend upon the size and age of the human or animal. However an amount of the dried, ready-to-eat cereal product to provide a daily amount of about 10^9 to about 10^{12} cells of the probiotic micro-organism would usually be adequate.

Numerous modifications may be made to the embodiments described above. For example, it is not necessary to

produce the cereal product by extrusion cooking. Instead the cereal product may be produced by any suitable method of producing dried, ready-to-eat cereal pieces. For example, the feed materials may be cooked with water to provide a cooked paste. The paste is then roller-dried to produce dried flakes; usually of a thickness of about 0.6 to about 1 mm.

Specific examples are now described for further illustration.

Example 1

A feed mixture is made up of corn, corn gluten, chicken and fish meal, salts, vitamins and minerals. The feed mixture is fed into a preconditioner and moistened. The moistened feed leaving the preconditioner is then fed into an extruder-cooker and gelatinised. The gelatinised matrix leaving the extruder is forced through a die and extruded. The extrudate leaving the die head is cut into pieces suitable for feeding to dogs, dried at about 110°C for about 20 minutes, and cooled to form pellets. The water activity of the pellets is about 0.6.

The pellets sprayed with three different coating mixtures. Each coating mixture contains *Bacillus coagulans* but one coating mixture uses hydrogenated soy fat as a coating substrate, one coating mixture uses water as a coating substrate, and one coating mixture uses a protein digest as a coating substrate. The *B. coagulans* is in the form of powdered endospores and is obtainable from Sankyo Pharmaceutical Company under the trade name Lacris-S. The pellets contain about 1.6×10^6 cells/g of *B. coagulans*. For each coating mixture, the pellets are separated into two groups. One group is stored at about 25°C and, to estimate the long term stability of the micro-organism, the other group is stored at about 37°C. A sample is taken of each group is taken after 1 week, 2 weeks, 3 weeks and 4 weeks. Also, a fat coated sample of the group which is stored at 37°C is taken at 8 weeks.

The cell counts are determined for each sample. The results are set out in Figure 1. In all cases, the cell counts remain substantially constant indicating excellent storage stability. Further, the results from the storage at 37°C for 8 weeks indicate that the micro-organisms are likely to be stable after one year of storage at normal conditions.

Example 2

Example 1 is repeated except that the three different coating mixtures each contain *Bacillus subtilis* instead of *Bacillus coagulans*. The *B. subtilis* is in the form of powdered endospores and is obtainable from Hansen A/S under the trade name BioPlus 2B. The results are set out in Figure 2.

In all cases, the cell counts remain substantially constant indicating excellent storage stability. However the cell counts for the pellets coated with fat are a little lower than those for water and protein digest but are still substantially constant. Again the results from the storage at 37°C for 8 weeks indicate that the micro-organisms are likely to be stable after one year of storage at normal conditions.

Example 3

Example 1 is repeated except that the three different coating mixtures each contain *Pediococcus acidilactici* instead of *Bacillus coagulans*. The *P. acidilactici* is in the form of a dried powder and is obtainable from Lallmand SA under the trade name Bactocell. The storage results are as follows:

Weeks	Fat 25°C	Fat 37°C	Water 25°C	Water 37°C	Digest 25°C	Digest 37°C
0	19.6×10^6	19.6×10^6	21.9×10^6	21.9×10^6	12.9×10^6	12.9×10^6
1	13.6×10^6	13.6×10^6	14.7×10^6	14.7×10^6	12.1×10^6	2.93×10^6
2	12.9×10^6	12.9×10^6	13.1×10^6	13.1×10^6	-	-
3	9.73×10^6	6.69×10^6	16.0×10^6	6.07×10^6	7.77×10^6	0.76×10^6
4	12.9×10^6	4.6×10^6	14.0×10^6	5.31×10^6	-	-
5	-	-	-	-	5.1×10^6	0.68×10^6
8	6.8×10^6	1.5×10^6	-	-	-	-

For the pellets coated using water or fats, the cell counts remain substantially constant at about 10^7 cfu/g; indicating excellent storage stability. For the pellets coated using protein digest, when stored at 37°C, the cell counts initially fall off but then stabilise at about 10^6 cfu/g; which is adequate.

Example 4

Example 1 is repeated except that the three different coating mixtures each contain *Saccharomyces cerevisiae* instead of *Bacillus coagulans*. The *S. cerevisiae* is in the form of a dried powder and is obtainable from Santel SA under the trade name Levucell. The storage results are as follows:

Weeks	Fat 25°C	Fat 37°C	Water 25°C	Water 37°C	Digest 25°C	Digest 37°C
0	28.0 x10 ⁶	28.0 x10 ⁶	27.6 x10 ⁶	27.6 x10 ⁶	11.3 x10 ⁶	11.3 x10 ⁶
1	23.2 x10 ⁶	23.3 x10 ⁶	17.2 x10 ⁶	17.2 x10 ⁶	7.53 x10 ⁶	1.83 x10 ⁶
2	24.5 x10 ⁶	24.5 x10 ⁶	18.7 x10 ⁶	18.7 x10 ⁶	-	-
3	24.5 x10 ⁶	9.93 x10 ⁶	13.5 x10 ⁶	4.40 x10 ⁶	1.99 x10 ⁶	0.16 x10 ⁶
4	13.7 x10 ⁶	15.9 x10 ⁶	-	-	-	-
5	-	-	-	-	2.42 x10 ⁶	0.03 x10 ⁶
8	17.5 x10 ⁶	12.3 x10 ⁶	-	-	-	-

For the pellets coated using water or fats, the cell counts remain substantially constant at about 10⁷ cfu/g; indicating excellent storage stability. This is particularly the case for the pellets coated with fats. However the cell counts for the pellets coated with protein digest are a little lower than those for water and fat but are still acceptable when stored at 25°C. When stored at 37°C, the cell counts for the pellets coated with protein digest fall off.

Example 5

A trial is conducted using 30 dogs. The dogs are fed a standard dried diet for a week prior to commencement of the trials. Immediately prior to commencement of the trials, the gut flora and a measure of the faecal odours for each dog is determined.

The dogs are then separated into two groups of 15 dogs. One group of dogs is fed the dried, fat coated pellets of example 1. The other group of dogs is fed the same pellets but without the coating of fat and probiotic micro-organism. The dogs are given free access to the food and to water.

After a week, the gut flora of each dog is analysed. The dogs which are fed the pellets of example 1 have decreased counts of *C. perfringens*. Further, faecal pH and odours are found to have decreased in the dogs which are fed the pellets of example 1.

Example 6

A feed mixture is made up of 70% by weight of corn flour, 17% by weight of wheat flour, 7% by weight sugar, 3% by weight of malt, 2% by weight of vegetable fats, and salt. The feed mixture is fed into a preconditioner and moistened. The moistened feed leaving the preconditioner is then fed into an extruder and gelatinised. The gelatinised matrix leaving the extruder is forced through a die and extruded. The extrudate expands upon leaving the die head and is cut into pieces of about 1 cm. The pieces are then dried to a moisture content of about 1% by weight.

The pieces are sprayed with two different coating mixtures. Each coating mixture contains sunflower oil as the carrier substrate but a different micro-organism. The micro-organisms are:

Micro-organism	Source	Form
<i>Saccharomyces cerevisiae</i>	Santel SA (Levucell TM)	Spray dried powder
<i>Enterococcus faecium</i> SF68	Bioferment Division of Cerbios Pharma SA (LBC-K TM), Switzerland	Spray dried powder

Both micro-organisms are commercially available. The pieces all contain about 10⁶ cells/g to 10⁷ cells/g of the pro-

biotic micro-organism. To obtain an idea of the long term stability of the micro-organism, the pieces are stored at about 37°C. A sample of each group is taken immediately after production, after 1 week and 3 weeks.

The viable cell counts are determined for each sample. The results are as follows:

Micro-organism	Cell count - Day 1 (cells/g)	Cell count - 1 week (cells/g)	Cell count - 3 weeks (cells/g)
<i>Saccharomyces cerevisiae</i>	6.40×10^6	2.21×10^6	3.90×10^6
<i>Enterococcus faecium</i> SF68	1.38×10^6	8.60×10^6	4.03×10^6

The results indicate that the probiotic micro-organisms remain substantially stable.

Example 7

The procedure of example 6 is repeated except that the coating mixture is a dry mix of the probiotic micro-organisms and chocolate-flavoured powder (Nesquik® powder). The dry mix is coated on the pieces using the procedure described in US patent 4,777,056 and using vegetable oil as an agglomerating agent.

Further, the following micro-organisms are used:

Micro-organism	Source	Form
<i>B. coagulans</i>	Sankyo Pharmaceutical Company (Lacris-S™), Japan	Powdered endospores
<i>L. johnsonii</i> La1	Nestec SA	Freeze dried powder
<i>Bifidobacterium animalis/longum</i>	Ch. Hansen A/S (Bb12™), Denmark	Freeze dried powder
<i>Saccharomyces cerevisiae</i>	Santel SA (Levucell™)	Spray dried powder
<i>Enterococcus faecium</i> SF68	Bioferment Division of Cerbios Pharma SA (LBC-K™), Switzerland	Spray dried powder

The first, third, fourth and fifth micro-organisms are commercially available. The second micro-organism is described in EP 0577904 and was deposited at the Collection Nationale de Cultures de Microorganismes (CNCM), Institut Pasteur, 28 rue du Dr Roux, 757724 Paris Cedex 15, France on 30 June 1992 under the number CNCM I-1225 and name La 1 by Nestec S.A.

The cell counts determined for each sample. The results are as follows:

Micro-organism	Cell count - Day 1 (cells/g)	Cell count - 1 week (cells/g)	Cell count - 3 weeks (cells/g)
<i>B. coagulans</i>	6.37×10^6	5.07×10^6	4.24×10^6
<i>L. johnsonii</i> La1	1.43×10^6	3.21×10^5	1.39×10^5
<i>Bifidobacterium animalis/longum</i>	8.06×10^6	2.95×10^6	9.80×10^5
<i>Saccharomyces cerevisiae</i>	2.43×10^5	2.17×10^5	1.38×10^5
<i>Enterococcus faecium</i> SF68	1.94×10^6	5.70×10^5	1.50×10^4

The results indicate that the *B. coagulans* and *Bifidobacterium animalis/longum* are likely to remain stable for long periods. The other micro-organisms display less but acceptable stability.

Example 8

Expanded cereal products produced as described in example 6 are coated with three coating substrates. Product 1 is prepared by coating the cereal product with vegetable oil and then dusting on a spray-dried milk powder which contains *L. johnsonii* La1; Product 2 is prepared by coating the cereal product with vegetable oil and then dusting on a mixture of a spray-dried milk powder which contains *L. johnsonii* La1 and a cocoa-containing powder (Nesquik[®] powder); Product 3 is prepared by suspending a spray-dried milk powder which contains *L. johnsonii* La1 in a vegetable oil and spraying the oil (without pressure) on the cereal product.

The cell counts determined for each product. The results are as follows:

Product	Cell count - Day 1 (cells/g)	Cell count - 1 week (cells/g)	Cell count - 3 weeks (cells/g)
1	3.86×10^7	4.42×10^7	3.00×10^7
2	1.59×10^7	2.30×10^7	1.65×10^7
3	3.51×10^7	4.61×10^6	3.36×10^6

The results indicate that the probiotic micro-organisms remain substantially stable.

Example 9

A trial is conducted using 20 adult volunteers. Immediately prior to commencement of the trials, the gut flora of each volunteer is determined. The volunteers are then separated into two groups of 10 people. One group is fed, for breakfast, a 30 g portion of product 1 of example 8 along with cold milk. The other group is fed the same cereal product but without the coating of fat and probiotic micro-organism. Other meals during the day are the normal meals eaten by the volunteers.

After a week, the gut flora of each volunteer is analysed. The volunteer which are fed Product 1 have decreased counts of *C. perfringens*.

Claims

1. A dried, ready-to-eat cereal product comprising a gelatinised starch matrix which includes a coating or filling containing a probiotic micro-organism.
2. A cereal product according to claim 1 in the form of a breakfast cereal, an infant cereal, or a convenience food.
3. A cereal product according to claim 1 or claim 2 in which the gelatinised starch matrix is in flaked or expanded form.
4. A cereal product according to claim 1 in the form of a pet food.
5. A cereal product according to any of claims 1 to 4 in which the gelatinised matrix is an extrusion cooked starch source.
6. A cereal product according to any of claims 1 to 5 in which the coating or filling comprises a carrier substrate which contains the probiotic micro-organism.
7. A cereal product according to claim 6 in which the carrier substrate is a fat, a protein digest, milk solids, a sugar or a particulate flavouring agent.
8. A cereal product according to claim 5 further comprising a lipid layer on the gelatinised starch matrix, the lipid layer causing a particulate carrier substrate, which contains the probiotic micro-organism, to adhere to the gelatinised starch matrix.
9. A cereal product according to any of claims 1 to 8 in which the probiotic micro-organism is selected from *Bacillus coagulans*, *Bacillus licheniformis*, *Bacillus subtilis*, *Bifidobacterium animalis/longum*, *L. johnsonii* La1, *Pediococcus*

cus acidilactici, *Saccharomyces cerevisiae*, and *Enterococcus faecium* SF68.

10. A cereal product according to any one of claims 1 to 9 further containing a source of soluble fibre.

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FIG.1.

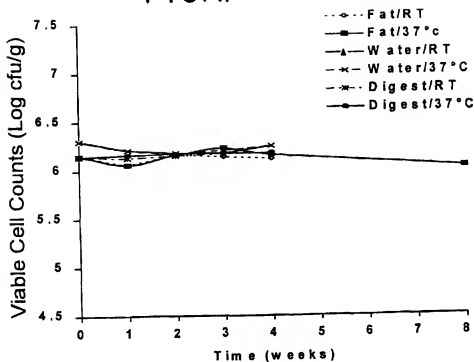


FIG.2.

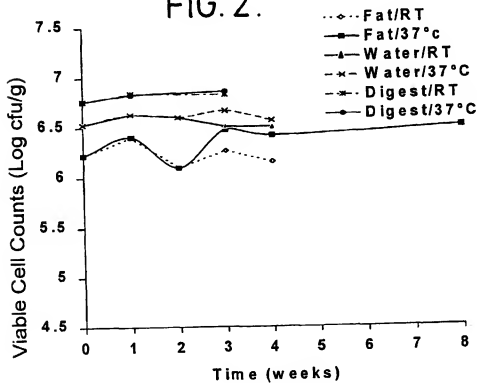


Exhibit E



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(54) Title: ZINC AND LINOLEIC ACID CONTAINING FOOD

(57) Abstract

The present invention relates to a diet or foodstuff and a dietary supplement comprising zinc at a concentration of above 28 mg/400 kcal and linoleic acid at a concentration of at least 4g/400 kcal or zinc at a concentration of 20 mg/400 kcal or above and linoleic acid at a concentration of 6 g/400 kcal or above. The diet/foodstuff and dietary supplement are useful in enhancing and/or improving the skin and coat condition of an animal. The present invention also relates to the use of the diet/foodstuff and dietary supplement in enhancing and/or improving the skin and coat composition of an animal and to processes for the preparation of the diet/foodstuff and dietary supplement.

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ZINC AND LINOLEIC ACID CONTAINING FOOD

The present invention relates to a diet or foodstuff and a dietary supplement comprising zinc at a concentration of above 28 mg/400 kcal and linoleic acid at a concentration of 4 g/400 kcal or above, or zinc at a concentration of 20 mg/400 kcal or above and linoleic acid at a concentration of 6 g/400 kcal or above. The diet/foodstuff and dietary supplement are useful in enhancing and/or improving the skin and coat condition of an animal. The present invention also relates to the use of the diet/foodstuff and dietary supplement in enhancing and/or improving the skin and coat composition of an animal and to processes for the preparation of the diet/foodstuff and dietary supplement.

In most household pets, a healthy skin and coat indicates an animal in general good health. Since skin and coat problems are common in household pets, much research has gone into providing diets which repair deteriorations in skin and coat conditions, thus providing a basic level of healthy skin and coat. Dietary deficiencies in zinc or linoleic acid have been shown to produce deteriorations in skin and coat conditions in dogs and cats (Miller W.H., Veterinary Clinics of North America; Small Animal Practice, Vol. 19, No. 3, May 1989, 497-511; Campbell K.L., Veterinary Dermatology, Vol. 4, No. 4, 167-173, 1993; Lloyd D.H., Journal of Small Animal Practice (1989) 30, 207-212). Such deteriorations are reversed when the animal is fed a complete and balanced food (including a high quality commercial food). Levels of nutrients in pet foods are well documented as to the provision of a complete and balanced food for healthy animals. Variations on individual ingredients are usually kept within well defined limits. Concentrations of individual ingredients far in excess of these limits may cause detrimental/toxic effects. In fact, European Community legislation currently prevents the sale of dog foods containing greater than 28 mg/400 kcal of zinc. Furthermore it is reported in Muller and Kirk's Small Animal Dermatology, 5th Edition, W.B. Saunders Company, 1995, that pets that are fed high-quality commercial foods typically receive no benefits from additional supplements.

As the skin and coat condition of a pet provides such an important visual impact (in particular to pet owners and/or to the public in general) it is, and has been, of considerable interest to be able to deliver visible enhancements on animals with already good (healthy) skin and coat condition. This has previously not been within the control of pet owners. Furthermore, humans are constantly trying to improve skin and hair conditions.

Accordingly, the present invention provides, according to a first aspect, a diet or foodstuff, comprising zinc at a concentration of above 28 mg/400 kcal and linoleic acid at a concentration of at least 4 g/400 kcal (4 g/400 kcal or above), or zinc at a concentration of 20 mg/400 kcal or above and linoleic acid at a concentration of 6 g/400 kcal or above. Throughout this text, references to concentrations per kcal are to kcal total metabolisable energy intake. A diet/foodstuff according to the first aspect has been shown to be effective in producing superior skin and coat condition in animals. Without being limited to the particular mode of action of the invention, it is believed to be effective as follows: Zinc is a part of a number of enzyme systems involved in skin and hair growth; linoleic acid is an essential nutrient for maintenance of the skin's barrier function and the precursor of arachidonic acid, which regulates the turnover of skin cells. Super-supplementation of a food with a combination of higher than normal levels zinc and linoleic acid provides a) a glossier coat or glossier hair, b) reduced skin scales (dander), and c) improved skin barrier function. The role of the zinc may be associated with the adherence of skin scales and hair scales to each other, while the role of the linoleic acid is thought to be associated with the physical gloss of the hair.

The present invention relates, for all aspects, to any animal, in particular those with substantial hair on the surface of the skin which forms a coat. The invention relates, in particular, to humans, horses, cats and most preferably to dogs.

The invention provides a dramatic improvement when the high levels of zinc and linoleic acid are used in combination. Such an improvement indicates a degree of synergism between the zinc and linoleic acid. It has been suggested that zinc may augment the metabolism and digestion of polyunsaturated fatty acid (but there has been no scientific evidence to support this theory).

The first aspect of the invention is preferably used in combination with a complete and balanced food (for example, as described in National Research Council, 1985, Nutritional Requirements for Dogs, National Academy Press, Washington D.C. or Association of American Feed Control Officials, Official Publication 1996). A complete and balanced diet includes a high quality commercial food. A high quality commercial food can be defined as a diet manufactured to the nutrient recommendations of the National Research Council, 1985 (*supra*), wherein the digestibility of key nutrients is 80% or more.

The first aspect of the invention applies preferentially to a non-human animal diet or foodstuff which is a wet or dry composition (food). Wet food usually describes food which is sold in tins and has a moisture content of 70 to 90%. Dry food usually describes food which is of a similar composition, but with 5 to 15% moisture and therefore is presented as small biscuit-like kibbles. The diet or foodstuff can be made according to any method known in the art, such as in Waltham Book of Dog and Cat Nutrition, Ed. ATB Edney, Chapter by A. Rainbird, entitled "A Balanced Diet" in pages 57 to 74, Pergamon Press Oxford. The concentrations of zinc and linoleic acid to be added to the diet/foodstuff are calculated on the basis of the energy content of the diet/foodstuff and of any additional nutrients which may be consumed by the animal. Preferably, a complete and balanced food, (including a high quality commercial food) comprises the diet/foodstuff according to the invention.

The zinc and/or linoleic acid may be added at any time during the manufacture/processing of the diet/foodstuff, including at the end, as the last step

before packaging.

The concentration of zinc and the concentration of linoleic according to the invention, represent the lower limits of these ingredients. Preferred features of the invention are when one or both of the zinc and linoleic acid concentrations are raised and/or when one or both of the active constituents of marine fish oils are also present.

Preferred raised concentrations of zinc and linoleic acid are as follows:

- (a) When the concentration of zinc is above 28 mg/400 kcal and the concentration of linoleic acid is 4 g/400 kcal or above:

Zinc: 35 mg/400 kcal or above, or 40 mg/400 kcal or above.

Linoleic acid: 5 g/400 kcal or above, or 6 g/400 kcal or above.

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- (b) When the concentration of zinc is 20 mg/400 kcal or above and the concentration of linoleic acid is 6 g/400 kcal or above:

Zinc: 25 mg/400 kcal or above, or 30 mg/400 kcal or above, or 35 mg/400 kcal or above, or 40 mg/400 kcal or above.

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Linoleic acid: 7 g/400 kcal or above, or 8 g/400 kcal or above.

These preferred concentrations can be used in any combination, i.e. for (a) above: any concentration of zinc (from above 28 mg/400 kcal) can be used with any concentration of linoleic acid (from 4 g/400 kcal or above), for (b) above: any concentration of zinc (from 20 mg/400 kcal or above) can be used with any concentration of linoleic acid (from 6 g/400 kcal or above).

Upper limits of the zinc and linoleic acid concentrations are not restrictive. However,

preferred upper limits are: 100 mg/400 kcal for zinc and 8 or 9 g/400 kcal for linoleic acid.

The active constituents of marine fish oils are eicosapentaenoic acid (EPA) and docosahexanoic acid (DHA). Further advantageous effects of the present invention are noted when one or both of EPA and DHA are present, (preferably both). Inclusion of these constituents in the present invention will further provide for improved skin and coat/hair condition in animals. Pruritus (scratch-itch) is also reduced in non-human animals. Preferred levels of EPA are 250-500 mg/400 kcal, more preferably 300-400 mg/400 kcal. Preferred levels of DHA are 175-400 mg/400 kcal, more preferably 200-300 mg/400 kcal. The preferred concentrations can be used in any combination, i.e. any concentration of EPA can be used in combination with any concentration of DHA. Furthermore, any combination of EPA and DHA can be used in any combination with any concentration of zinc and/or linoleic acid according to the invention.

It has never previously been proposed to incorporate EPA and/or DHA into animal foods for any advantageous effect, particularly at the preferred levels of concentration according to the invention. The basis for this is the possible incorporation of EPA and/or DHA into platelet cell membranes and associated risk of reduced platelet function (blood clotting ability) in animals. The present invention has demonstrated that this is not the case. Evidence based on measurements of prothombin and partial thromboplastin times have shown that blood clotting is not impaired.

In addition to the above, it has been determined, surprisingly, that inclusion of EPA and/or DHA, particularly at the preferred levels according to the invention does not result in product malodour, animal halitosis or coat malodour. This is surprising because EPA and DHA are the active constituents of marine fish oils and a fishy smell usually results from their use. Since EPA and DHA have anti-inflammatory potential, their inclusion, from a marine fish oil source can be, from a nutritional point of view,

extremely advantageous and the perceived risk of pancreatitis, based on the evidence of consumption of high fat diets, does not apply when the total fat consumption of a diet is not increased, as per the present invention.

- 5 Of course, the source of EPA and/or DHA for inclusion in the present invention is not limiting. Marine fish oil typically contains 18% EPA and 12% DHA and is the preferred source for these fatty acids.

10 The source of zinc or of linoleic acid is not limiting. Preferred zinc sources include zinc sulphate, zinc oxide, organic zinc complexes or a combination of two or more thereof.

15 Preferred linoleic acid sources include safflower oil, sunflower oil, soyabean oil, other plant, or animal oils/fats or a combination of two or more thereof. Since zinc and linoleic acid are ubiquitous in food, it will usually be necessary to determine the concentration of each which is present in the ingredients of the diet/foodstuff and then add sufficient quantities to bring the total concentration of each up to the required levels, according to the invention.

20 According to a second aspect of the invention there is provided a dietary supplement which, in addition to other nutrient intake, supplies a total zinc concentration of above 28 mg/400 kcal and a total linoleic acid concentration of 4 g/400 kcal or above, or zinc at a concentration of 20 mg/400 kcal or above and linoleic acid at a concentration of 6 g/400 kcal or above. This aspect of the invention is particularly useful to
25 supplement a diet/foodstuff, which does not contain sufficiently high levels of zinc/linoleic acid (according to the invention). The concentrations of zinc/linoleic acid in the diet/foodstuff can easily be determined by typical or guaranteed analysis declared by the manufacturer either on the label or in supplementary material or by nutritional analysis of the diet and the required amount of supplement can be added to
30 the animal's diet. This can be done by including a quantity of the supplement with

the animal's diet or by additionally feeding a quantity of the supplement to the animal. The supplement can be formed as a foodstuff with extremely high levels of zinc/linoleic acid which requires "dilution" before feeding to an animal. The supplement may be in any form, including solid (e.g. a powder), semi-solid (e.g. a food like consistency/gel) or a liquid. The liquid form can conveniently be mixed with food or fed directly to the animal, for example via a spoon or via a pipette-like device. The supplement can be high in both linoleic acid and zinc or can be a combined pack of at least two components, having the required concentration of zinc and linoleic acid separately (either diluted or any level of concentration).

All features of the first aspect of the invention, as described above, also apply to the second aspect of the invention (raised levels, other constituents etc.).

A further aspect of the invention provides a composition for topical administration to animals comprising zinc and linoleic acid at high levels (according to the first and second aspects of the invention).

The composition can be applied from one source or from more than one. For example, a combined pack having a source of zinc and a source of linoleic acid.

The topical composition is applied in the usual manner to the animal's coat or hair. The composition is most suitably in liquid or in powder form.

Any of the first to third aspects of the invention may provide simultaneous, separate or sequential provision of the required levels of zinc and linoleic acid.

The present invention also provides, according to a fourth aspect, a diet or foodstuff as set out for all features of the first aspect, a dietary supplement as set out for all features of the second aspect, and a composition as set out for all features of the third aspect, for use in enhancing and/or improving the skin and coat condition of an animal.

A fifth aspect of the invention also provides for the use of all features of the first, second and third aspects of the invention for enhancing and/or improving the skin and coat condition of an animal. This aspect of the invention correlates with a method for
5 enhancing and/or improving the skin and coat condition of an animal by administration of any feature of the first to third aspects of the invention.

The invention is cosmetic in that it produces its effect in normal/healthy animals with good skin and coat condition, as well as those with dry scaly skin. The invention does
10 not relate to the correction of real or marginal deficiencies, rather, it provides performance enhancement for healthy animals and can do so via a complete and balanced diet. It delivers visible enhancement on animals with already good skin and coat hair condition.

15 Improvements in skin and coat conditions according to the invention may also be associated with improved skin barrier function by the reduction of transepidermal water loss.

Improvements in skin and coat condition, according to the invention, may be
20 determined by a quantitative descriptive analysis panel. This panel involves a specialist group of people to assess a number of characteristics of the animals being tested. This form of analysis is currently used in the cosmetics and health-care products in industry evaluation of and is described as follows:

25 **The Quantitative Descriptive Analysis Panel**

The following document identifies the methodology used to set up the Quantitative Descriptive Analysis (QDA) panel. It includes a description of the recruitment, training, validation and every day running of the panel.

1. The History

During 1994 and 1995, when the first skin and coat projects were getting underway, a panel of 15 associates were used to assess the condition of the cats' and dogs' coats in an attempt to provide a benchmark against how well products were feedings. The panel proved to be highly variable and lacked consistency. Some individuals showed biases. Data points were also frequently missing, due to individuals being unable to attend assessment sessions, as a result of prior engagements. Analysis of this poor quality data was difficult and never showed any statistical differences because of the noisy data.

A specialist panel of people was therefore required to assess the cats and dogs, and a consistent method of assessment needed to be adopted.

2. The Recruitment

It was essential to identify individuals who were interested in their task, and that were motivated to carry out a thorough assignment for the duration of the trial. For any animal assessments it is essential that potential recruits should:

- i) be comfortable with handling animals, although they do not have to be animal owners themselves,
- ii) not suffer from any allergies which may affect their ability to carry out the assessments,
- iii) not suffer from abnormal colour vision – there are tests available to monitor for colour blindness and discrimination of colour,
- iv) have normal eyesight (with correction if necessary) and, if glasses are worn for close work, they should be worn for the assessments,
- v) be able to devote time to the assessments for the duration of the trial,
- vi) although not essential, it is useful if the group selected cover a broad age range;

- including both sexes can have advantages in forming a balanced group,
- vii) be identified as having good senses,
 - viii) skills to observe for, during recruitment include teamwork, decision making and judgement, commitment and inter-personal effectiveness; these skills are
- 5 essential if the panel are to succeed.

N.B. If the assessors are animal owners, then care should be taken to ensure, that if a trial animal has the same visual appearance (e.g. colour or breed), there is no bias in terms of favourable scoring.

10

3. Assessor Training

A small, well-trained panel is much better than a large untrained panel. For a dog study 20 potential candidates are selected, who demonstrated the necessary skills (listed above – section viii) at interview. These 20 people then began a training course,

15 lasting approximately 12 hours over 3 days. During the first day the panel were introduced to the principles of assessment with 5 reference cats. The assessors were then asked to assess 8 cats, of differing colours and coat types, two of which were the same cat (we pretended they were sisters!).

20

This test monitors the consistency of individuals, looks at their ability to use the scale properly and can be used to compare their score against the panel mean to eliminate any biases. They were also asked to smell 3 dogs and rank them in order of offensiveness. This gave us an indication of how well the assessors handled the dogs

25 and cats and an indication of their sensory skills. The best 10 assessors were selected to complete the next training session.

Day two involved assessing the same 8 cats, to see how repeatable the assessors were. They also completed a more complex odour recognition test and odour ranking test, to

30 identify how sensitive their noses were! The best 5 assessors were then recruited onto

the panel.

Day 3 involved more open discussions around the parameters to be assessed. This encouraged the group to get to know each other and learn to work together, as a team. Some time was also spent evaluating the Reference animals, a group of animals (preferably fed the same diet) which represent extremes of the scale in terms of coat condition.

These Reference animals are also assessed at the beginning of each assessment for half an hour. This provides the forum for a discussion to ensure they are all in agreement. A panel leader must run this discussion, to ensure that the quieter assessors give their views and do not just agree with the more dominant ones.

4. Presentation of animals

- ◆ The animal should be assessed in a random order, at each assessment stage, to eliminate any bias towards the first or last animals presented.
- ◆ Between each assessment the assessors should wipe their hands with an alcohol tissue or wash them with soap and water.
- ◆ Each animal should be examined by the assessors as a group but, to avoid any effect of change in coat texture during handling, the assessors should touch each animal in the same sequence.
- ◆ Each animal should only be identified by an unmemorable number, not by name. This prevents any subconscious favouritism and prevents recall of previous scores.
- ◆ Each animal should be assessed under identical conditions, preferably indoors, to provide an even and consistently lit area.
- ◆ Prior to evaluation, the coat should be combed evenly all over, in a standardised manner, to eliminate the influence of any disturbances in the way the coat is lying. A clean comb should be used for each animal. Combs should be de-greased in

alcohol or methylated spirits.

5. Assessment Considerations

- 5 ♦ The sensory evaluation techniques rely upon a critical judgement made on each occasion. The assessors must understand that they are making an independent evaluation of an animal on a specific occasion. The assessors must be blind to all treatment groups that the animals may belong to. There is no harm however in giving some information about the trial e.g. something has been added to the diets of some of the animals to see if it has any effects on any aspects of the animals' coat condition. They may help to keep their interest levels high and make them feel they are doing a worthwhile job.
- 10 ♦ The scoring system to be used should comprise a numerical scale for each parameter under evaluation. The scale is a simple category scale with a minimum of 5 categories for the purpose of statistical analysis. The scale currently used by the QDA panel appears to be a line scale, but is in fact used as a category scale i.e. crosses are only marked on the whole and half numbers and not anywhere along the line.
- 15

20 6. Assessment Parameters

1. Gloss – this should be evaluated before touching the animal, so that the texture of the coat does not influence the assessor. The coat should be examined for the extent of light reflected from the coat. The darker coloured coats will naturally reflect more light than the lighter coats, but the mixed coloured coats e.g. a brindle dog, tortoiseshell cat or roan horse can cause confusion and variability. These should be excluded from the trial if possible and ideally use one colour of animal only. If this is not possible, the panel should simply judge the gloss reflected from the different coloured areas and give an average score.
- 25

2. Softness – if possible the assessors should not just stroke the coats, but also get their fingers into the coat so that the true feel of the coat is detectable. In the case of horses this may not be possible if they are clipped, but in conjunction with an assessment of the softness of the mane and/or tail a better picture may be given. This highlights the importance of ensuring the grooming practises for each animal are identical, and if one is clipped they should all be clipped.

3. Grease/Dryness – this parameter can be assessed at the same time as softness. Very often a greasy or dry feel are confused, hence the QDA panel now assess grease and dryness against an optimum feel.

4. Scale – the animal's body needs to be visually sectioned off into six areas. Assessments should be carried out, section by section, lifting the hairs in the opposite direction of growth, examining the skin and base of the hairs for signs of flaking. N.B. lighter coats may need very careful inspection. The scores, for each section, are then summed for the whole body and translated onto the scoring line. By dividing the body into six, the most accurately scored parameter has been created.

5. Erythema – an especially important parameter to assess when testing topical products to ensure no irritation occurs.

A sixth aspect of the invention provides a process for the preparation of any of the first, second or third aspects of the invention. The process comprises mixing together the ingredients, optionally heating to cook any raw food ingredients and presenting the mixture in a form suitable for consumption or administration to an animal.

As previously discussed, the zinc and linoleic acid (all or some of the required total) can be introduced into the mixture at any stage. Preferably the diet or foodstuff is a wet or dry product. Preferably, the supplement and/or composition is a powder or

liquid.

The present invention is described with reference to the drawings relating to Example 1, of which:

5

FIGURE 1 is a graph showing improvements in coat gloss.

FIGURE 2 is a graph showing improvements in coat scale.

10

FIGURE 3 is a graph showing the reduction in transepidermal water loss and improvements in skin barrier function.

The invention will now be described with reference to the following non-limiting examples:

15

Example 1

Summary

20

- This trial evaluated linoleic acid and zinc as nutritional drivers of superior skin and coat condition.
- 32 Labrador Retriever dogs were initially fed a complete balanced diet (see below) for nine weeks. Labaradors were used as they are a breed with relatively constant coat colour thereby avoiding any differences in gloss which could be attributed to differences in coat colour. The following nine weeks they were divided into four groups offered either the complete balanced diet alone or supplemented with linoleic acid, zinc or a combination of the two.
- Levels of linoleic acid and zinc in the control and test diets were 1.8 or 6 g/400 kcal and 12.5 and 40 mg/400 kcal, respectively.

25

- The parameters evaluated included the visual assessment of coat quality by trained assessors and transepidermal water loss.
- No significant differences were detected between diets in coat softness or optimum coat feel.
- 5 • A significant increase ($p=0.05$) in coat gloss was observed in the group supplemented with the combination of zinc plus linoleic acid compared to the control group.
- Supplementation with zinc plus linoleic acid was also associated with a substantial and significant ($p=0.0002$) improvement in skin scale.
- 10 • There was a significant decrease ($p=0.05$) in the transepidermal water loss of the dogs skin in the groups supplemented with either zinc or linoleic acid plus zinc which was not seen in the control group.
- These data clearly demonstrate that increased dietary zinc and linoleic acid intakes are associated with significant and substantial improvements in skin and coat
- 15 condition and skin barrier function.

Composition of Complete Balanced Diet

	<u>Ingredient</u>	<u>Inclusion</u>
5	Rice	24.9%
	Whole corn	18.8%
	Whole grain wheat	12.2%
	Chicken by-product meal	18.7%
10	Corn gluten meal	9.5%
	Brewers yeast	1.7%
	Dried egg	0.8%
	Non-iodinised salt	0.7%
	Vitamin premix	3.4%
15	Sunflower oil	0.5%
	Beef tallow	4.9%
	Poultry viscera	4.4%
20	Analytical profile – moisture 8.2%, protein 26.4%, fat 10.4%, ash 7.1%, fibre 2.2%.	

Methods1. Trial Set-upa) *Animals, Location and Feeding.*

The trial was conducted in Dog Care 6 at WCPN utilising 32 adult Labradors (31 black, 1 yellow) which were divided into four panels (yellow dog placed in control group), matched for age, gender and coat condition. The dogs were fed to maintain

their bodyweight and therefore bodyweights were monitored weekly. Amounts offered were adjusted to compensate for any excessive gain or loss of bodyweight.

b) Trial Design.

- 5 All four panels of dogs were offered the standard complete balanced diet so that all panels were standardised with respect to skin and coat condition. Immediately following this prefeed each panel of dogs was fed with either the standard complete balanced diet or one of the supplemented test diets, for an additional nine weeks, as outlined in Table 1.

10

Table 1. Trial Design of Phase I

Test Weeks	Period	Panel 1	Panel 2	Panel 3	Panel 4
0 - 9	Prefeed	Standard Diet	Standard Diet	Standard Diet	Standard Diet
10 - 18	Phase I	Standard Diet	Standard diet + linoleic acid	Standard Diet + zinc	Standard Diet + linoleic acid + zinc

15 *c) Foods*

A single batch of complete balanced diet was made up. Analysis of the diet revealed a zinc level of 12.5mg/400 kcal as specified. Zinc supplementation was added at the time of feeding in the form of zinc sulphate.

20

Linoleic acid was added directly to the diet at the time of feeding in the form of safflower oil (78% linoleic acid). The two groups of dogs receiving the safflower oil supplement had their food intakes adjusted to compensate for the increased energy intake from the oil.

The final levels of zinc and linoleic acid presented to the animals are indicated in Table 2 as measured by the techniques described in Appendix III. Essential fatty acid/linoleic acid levels were determined using gas liquid chromatography. Zinc levels were quantified by atomic absorption spectrophotometry. Both methods are approved by the National Accreditation of Measurement and sampling which is governed by the UK Accreditation Service.

Table 2. Levels of zinc and linoleic acid presented daily.

	Zinc (mg/400 kcal)	Linoleic acid (g/400 kcal)
Standard Level	12.5	1.8
Test Level	40	6

d) Grooming.

As grooming has a major impact on coat condition, a regular pattern of grooming was followed throughout the trial. All dogs were uniformly groomed once weekly and bathed with shampoo three weeks before the end of the prefeed.

2. Parameters Measured

a) Daily intake

The energy requirement of each animal was calculated at the beginning of each feeding stage and the amount offered was adjusted accordingly. Individual food intakes were recorded daily for each dog. Individual weekly bodyweights were measured to monitor and correct any over- or under-feeding.

b) *Sensory Evaluation of Coat Condition.*

The Quantitative Descriptive Analysis (QDA) panel was composed of five women who have been selected and trained, in house, to provide accurate and precise assessments of coat quality (for details refer to QDA described earlier).

- Coat gloss was measured before any manual examination of the animal was carried out. Gloss was assessed by scoring the amount of light reflected from the coat.
- Coat softness is a measure of the feel of the coat when the assessors run fingers through the full thickness of the coat.
- Optimum coat feel is an absence of either a greasy or a dry feel of the coat (as often the two are indistinguishable on the basis of feel alone) and was measured at the same time as the softness. This parameter is subdivided into two measurements; along the top of the back and along the flanks, as there is variability between these areas.
- Scale (dander) on the animals coat was an undesirable quality and is measured by visually assessing the amount of scale present in three different sections of the dogs' coat.

- Each of the five parameters was assessed in each dog twice at the end of the prefeed (week 8 and week 9) and twice at the end of the test phase (week 17 and week 18).

c) *Transepidermal Water Loss*

- Skin hydration was evaluated by measuring the conductivity of the skin using a dermal phase meter which yields a direct measure of the hydration of the stratum corneum. Continuous measurements taken over a 30 second period provide an indirect measure of transepidermal water loss. Measurements were taken in duplicate at the end of the prefeed stage (weeks 8 and 9) and at the end of the test phase (weeks 17 and 18) from

the inner surface of both left and right ears. These provide a direct assessment of skin barrier function.

3. Data Analysis and Presentation.

5

All results are presented as the change in parameters from the end of the prefeed (mean of weeks 8 and 9) to the end of the test phase (mean of weeks 17 and 18). Statistical differences between the changes observed in each panel were assessed by one-way analysis of variance (ANOVA). Statistical significance was reached when p is equal to or less than 0.05).

10

Results

15

No significant changes in either coat softness or optimum coat feel of the dogs were detected in this study following the addition of zinc, linoleic acid or a combination of the both in the diet, when compared to the control diet.

20

Statistical analysis compared the changes in coat gloss, from the end of the prefeed to the end of the test phase, between each of the different diets by one-way ANOVA. All three test panels showed an increase in coat gloss compared to the control group (Figure 1). The increases observed in the zinc group and the zinc plus linoleic acid group appeared to be additive when both supplements were delivered in combination, such that the dogs supplemented with the combination demonstrated a large (0.4 units on a 1 to 5 scale) and significant ($p=0.05$) increase in coat gloss (when compared to control group).

25

Changes in coat scale from the beginning to the end of the test phase was also analysed using one-way ANOVA to compare differences between diets. Note that a positive value represents a reduction in the amount of scale in the coat. Dogs supplemented with zinc or linoleic acid alone and those in the control group showed

30

no reduction in the amount of scale present over the test period (Figure 2). The group of dogs supplemented with the combination of zinc plus linoleic acid demonstrated a substantial (0.53 units) and significant ($p=0.0002$) improvement in coat scale (when compared to control group) representing a synergistic rather than additive effect.

5

During the test phase, dogs in the control group and those supplemented with linoleic acid alone showed no significant change in trans-epidermal water loss (TEWL; Figure 3). However, there was a trend for zinc to reduce TEWL over the test period. Supplementation with zinc was associated with a large, significant ($p=0.05$) decrease in TEWL over the test period. Supplementation with the combination of linoleic acid plus zinc also showed a moderate but significant ($p=0.05$) decrease in TEWL at the end of the test phase compared to the TEWL at the start of the test phase.

10

The results from all parameters are summarised in Table 3.

15

Table 3. Summary of results.

Parameter	Linoleic Acid	Zinc	Linoleic + Zinc
Gloss	↔	↔	↑
Softness	↔	↔	↔
Scale	↔	↔	↓
Optimum Coat Feel	↔	↔	↔
Transepidermal Water Loss	↔	↓	↓

20

Key: ↔ no change

↓ decrease

↑ increase

25

Discussion

5 Gloss is considered to be the major parameter in the assessment of coat condition as it is the first and most striking impression given by the dog. In this study the mean increase in gloss observed in the zinc plus linoleic acid group approached half a unit on a 1 to 5 scale. This magnitude of improvement is one that is easily and reproducibly distinguished by the QDA panel and would be detected by dog owners.

10 The dramatic improvement in scale observed in the group of dogs that received the combination of zinc plus linoleic acid, which was not seen in the other groups, indicates there is a degree of synergism involved when the supplements are combined.

15 Zinc was shown to play a significant role in the reduction of transepidermal water loss in this study as well as in the previous phase I. These results are indicative that zinc is active in improving skin health by boosting the cutaneous barrier function and therefore reducing the risk of dry scaly skin. This may explain the effects of zinc in reducing skin scale.

20 The results from this study represent the first research able to show that supplementation of a complete and balanced professional dog food, with zinc and linoleic acid concentrations in excess of those required to prevent deficiency, can make significant and substantial enhancements in the skin and coat condition of animals.

25

Conclusions

The rationale and the protocols used in this study have shown to be a valid and effective method for assessing the effect of nutrients on skin and coat condition. This

method can now be extended with the confident knowledge that nutrients which play a part in improving skin and coat condition can be identified by this protocol.

Zinc and linoleic acid have been identified in this study as ingredients involved in the promotion of superior skin and coat condition when provided in addition to an already balanced premium quality animal food.

Example 1a

A trial was conducted, as set out in Example 1, using a zinc concentration of 25 mg/400 kcal and a linoleic acid concentration of 6 g/400 kcal in a complete and balanced diet.

These levels of zinc and linoleic acid also showed the promotion of superior skin and coat condition to already healthy animals.

Example 2

THE EFFECT OF DIETARY SUPPLEMENTATION OF MARINE FISH OILS ON BLOOD COAGULATION PARAMETERS OF ADULT DOGS

Introduction

- ◆ This trial was carried out to test the safety of supplementing animal diets with relatively high amounts of marine fish oils (MFO). Marine fish oils, containing Eicosapentanoic acid (EPA) and Docosahexanoic acid (DHA) in particular, have been found to have an anti-inflammatory effect in humans and animals. They have also been shown to increase blood coagulation times at very high levels, which is an unacceptable adverse effect. In order to exploit the anti-inflammatory effects of these fatty acids in animals,

particularly dogs, it was necessary to test their safety. This was done by feeding double the amount of MFO that would have to be fed for an anti-inflammatory effect over a six month period. During this time blood samples are taken to monitor coagulation function.

5

Material and Methods

- 10 ♦ Six yellow coated Labradors retrievers were put on a six month diet of the previously described complete balanced diet with 4.67 g/400 kcal MFO inclusion. This corresponds to 489 mg/400 kcal EPA and 356 mg/400 kcal DHA in the finished product. The animals were fed to body weight maintenance.
- 15 ♦ Before feeding the diet, blood samples were collected for coagulation tests to establish a baseline. This was done at 21, 14 and 1 day before the start of diet. Subsequently, blood samples were taken every 4 weeks for coagulation tests.
- 20 ♦ The coagulation parameters that were measured were platelet count (platC), prothrombin time (prothrT), partial thromboplastin time (ptT) and fibrinogen (F). ProthrT and ptT are dynamic measurements of changes in coagulation times that would be expected to be influenced by the MFO in the diet.

Results

25

- ♦ No adverse clinical events were reported and no abnormalities were found in any animal on veterinary examination.

- ♦ The mean results (\pm standard error) for the 6 animals are shown in Table 4 for the four coagulation parameters

Table 4

5

	week	platelet count ($10^9/l$)	prothrombin time (seconds)	thromboplastin time (seconds)	fibrinogen (g/l)
	-3	290 ± 32	9.0 ± 0.2	15.9 ± 0.7	1.4 ± 0.2
10	-2	277 ± 27	9.0 ± 0.1	13.8 ± 0.3	1.8 ± 0.2
	0	283 ± 25	9.3 ± 0.3	12.3 ± 0.3	1.5 ± 0.2
	4	293 ± 25	9.3 ± 0.3	11.3 ± 0.4	1.3 ± 0.2
	8	273 ± 24	9.1 ± 0.4	14.0 ± 0.8	1.8 ± 0.3
	12	300 ± 26	10.3 ± 0.2	18.7 ± 0.5	1.1 ± 0.1
15	16	261 ± 27	8.2 ± 0.1	13.6 ± 0.4	1.0 ± 0
	20	268 ± 44	8.7 ± 0.1	12.3 ± 0.8	1.3 ± 0.1
	24	268 ± 30	9.3 ± 0.2	14.3 ± 0.5	1.8 ± 0.1
20	Normal range	150 – 450	6 – 11	10 – 20	1.0 – 4.0

- ♦ At no time were any of the parameters from any individual dog out of the normal ranges.
- 25 ♦ There was no perceivable increase in halitosis or coat malodour specifically of a fishy nature.

Conclusions

- 30 ♦ As the purpose of this trial was to assess the safety of longterm feeding of MFO at relatively high inclusion levels, it is important to note that none of the

animals were taken off trial because of health reasons. Furthermore, none of the mean values of the parameters increased or decreased to outside their normal range.

- 5 ♦ No adverse effects on clotting function were found as a result of longterm feeding of a diet containing amounts of MFO in excess of double those required for anti-inflammatory effects.
- 10 ♦ There was no perceivable increase in halitosis or coat odour as a result of the inclusion of MFO in the diet.

Recommendations

- 15 ♦ MFO can be used in our diets at the levels according to the invention without adverse effects.

CLAIMS

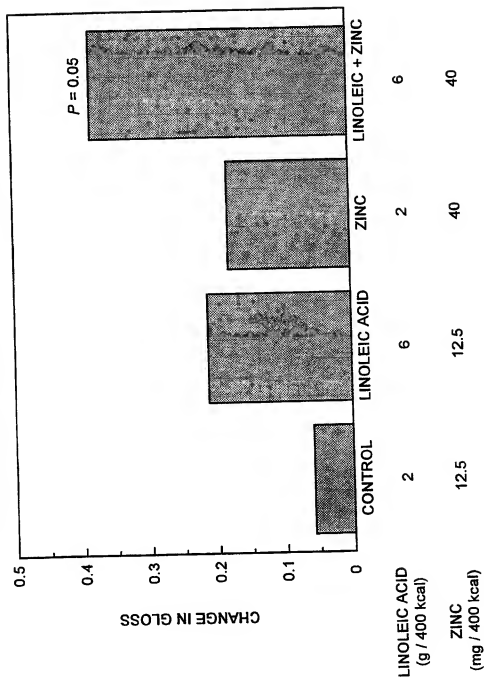
1. A diet or foodstuff comprising:
 - (a) zinc at a concentration of above 28 mg/400 kcal and linoleic acid at a concentration of 4 g/400 kcal, or above; or
 - (b) zinc at a concentration of 20 mg/400 kcal or above and linoleic acid at a concentration of 6 g/400 kcal or above.
2. A diet or foodstuff, as claimed in claim 1(a), wherein the zinc concentration is 35 mg/400 kcal or above, preferably 40 mg/400 kcal or above.
3. A diet or foodstuff, as claimed in claim 1(a) or claim 2 wherein the linoleic acid concentration is 5 g/400 kcal or above, preferably 6 g/400 kcal or above.
4. A diet or foodstuff, as claimed in claim 1(b), wherein the zinc concentration is 25 mg/400 kcal or above, preferably 30 mg/400 kcal or above, more preferably 35 mg/400 kcal or above most preferably 40 mg/400 kcal or above.
5. A diet or foodstuff, as claimed in claim 1(b) or claim 4, wherein the linoleic acid concentration is 7 g/400 kcal or above, preferably 8 g/400 kcal or above.
6. A diet or foodstuff, as claimed in any one of claims 1 to 5, which is for a dog, cat, horse or human.
7. A diet or foodstuff, as claimed in any one of claims 1 to 6, further including eicosapentaenoic acid at a concentration of from 250-500 mg/400 kcal.
8. A diet or foodstuff, as claimed in any one of claims 1 to 7, further including docosahexanoic acid at a concentration of from 175-400 mg/400 kcal.

9. A dietary supplement, which, in addition to other nutrient intake, supplies: (a) a total zinc intake at a concentration of above 28 mg/400 kcal and a total intake of linoleic acid at a concentration of 4 g/400 kcal or above; or (b) a total zinc
5 intake at a concentration of 20 mg/400 kcal or above and linoleic acid at a concentration of 6 g/400 kcal or above.
10. A supplement, as claimed in claim 9(a), wherein the total zinc intake is 35 mg/400 kcal or above, preferably 40 mg/400 kcal or above.
- 10 11. A supplement, as claimed in claim 9(a) or claim 10, wherein the total linoleic acid intake is 5 g/400 kcal or above, preferably 6 g/400 kcal or above.
12. A supplement, as claimed in claim 9(b), wherein the total zinc intake is 25
15 mg/400 kcal or above, preferably 30 mg/400 kcal or above, more preferably 35 mg/400 kcal or above, most preferably 40 mg/400 kcal or above.
13. A supplement, as claimed in claim 9(b) or claim 12, wherein the total linoleic acid intake is 7 g/400 kcal or above, preferably 8 g/400 kcal or above.
- 20 14. A supplement, as claimed in any one of claims 9 to 13 which is for a dog, cat, horse or human.
15. A supplement, as claimed in any one of claims 9 to 14 which, in addition to
25 other nutrient intake, supplies a total eicosapentaenoic acid concentration of from 250-500 mg/400 kcal.
16. A supplement, as claimed in any one of claims 9 to 15 which, in addition to
30 other nutrient intake, supplies a total docosahexanoic acid concentration of from 175-400 mg/400 kcal.

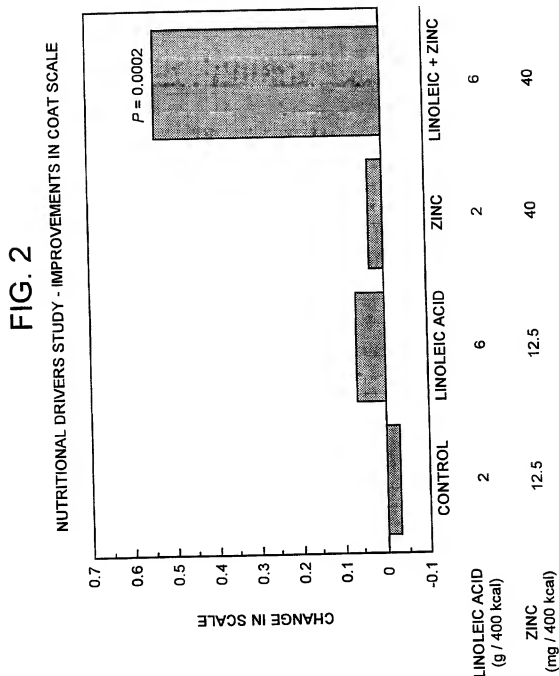
17. A supplement, as claimed in any one of claims 9 to 16, which is in liquid or solid (preferably powder) form.
- 5 18. A diet or foodstuff or supplement as claimed in any one of claims 1 to 17, wherein the zinc is in the form of zinc sulphate, zinc oxide or organic zinc complexes or a combination of two or more thereof.
- 10 19. A diet, foodstuff or supplement as claimed in any one of claims 1 to 18, wherein the linoleic acid is provided as safflower oil, sunflower oil, soyabean oil or a combination of two or more thereof.
20. A diet, foodstuff or supplement as claimed in any one of claims 1 to 19 for use in enhancing and/or improving the skin and coat condition of an animal.
- 15 21. A process for the preparation of a diet, foodstuff or supplement, as claimed in any one of claims 1 to 19, comprising mixing together the ingredients, optionally heating to cook any raw food ingredients and presenting the mixture in a form suitable for consumption or administration.
- 20 22. The use of a diet, foodstuff or supplement, as claimed in any one of claims 1 to 19, for enhancing and/or improving the skin and coat condition of an animal.
- 25 23. The use, as claimed in claim 22, wherein the animal is a dog, cat, horse or human.

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FIG. 1
NUTRITIONAL DRIVERS STUDY - IMPROVEMENTS IN COAT GLOSS



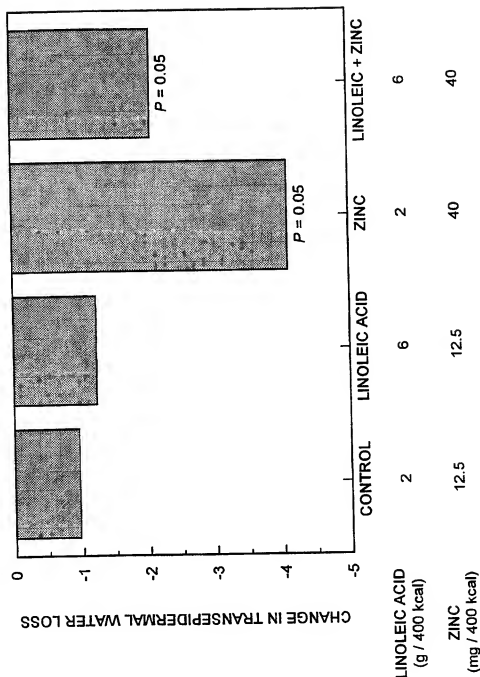
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FIG. 3

NUTRITIONAL DRIVERS STUDY - REDUCTION IN TRANSEPIDERMAL
WATER LOSS AND IMPROVEMENTS IN SKIN BARRIER FUNCTION



INTERNATIONAL SEARCH REPORT

Intern: of Application No

PCT/GB 98/01719

A. CLASSIFICATION OF SUBJECT MATTER

IPC 6 A23L1/304 A23L1/30 A23K1/175 A23K1/16 A23K1/18

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 6 A23L A23K A61K

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 003 407 A (VERRONAY) 8 August 1979 see claims 1-6, 15-17, 19 see page 3, line 1 - page 4 see page 5, line 1-16 see page 7, line 10 - page 8, line 1 see page 11, line 5-12; example 1	1-23
A	EP 0 037 175 A (EFAMOL) 7 October 1981 see claims 1, 7, 13, 14, 16, 17 see page 5, line 9-17 see page 5, line 26 see page 9, line 1 see page 10, line 1-21 see page 12; example A	1-23
A	EP 0 366 869 A (LYCON) 9 May 1990 see claims 1, 4, 7	1

☐ Further documents are listed in the continuation of box C.☒ Patent family members are listed in annex.

* Special categories of cited documents:

- "A" document defining the general state of the art which is not considered to be of particular relevance
- "E" earlier document but published on or after the international filing date
- "L" document which may throw doubt on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)
- "O" document referring to an oral disclosure, use, exhibition or other means
- "P" document published prior to the international filing date but later than the priority date claimed

"T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention

"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

"S" document member of the same patent family

Date of the actual completion of the international search

21 October 1998

Date of mailing of the international search report

29/10/1998

Name and mailing address of the ISA

European Patent Office, P.B. 5618 Patentstein 2
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Fax: (+31-70) 340-3016

Authorized officer

Van Moer, A

INTERNATIONAL SEARCH REPORT

Information on patent family members

International Application No.

PCT/GB 98/01719

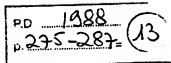
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		CA 2000849 A	17-04-1990
		WO 9004331 A	03-05-1990

Exhibit F

XP 000670866

Canine Nutrition — Recent Advances

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England



SUMMARY

The challenge in feeding strategy of the domestic dog by its owner and the potentially large market for complete dog diets, coupled with a decline in farm animal feed production, has resulted in an increase in the number of such diets being manufactured in the United Kingdom. Other than the basic nutrient requirements, there has been little information published or comparative and long term studies dealing with dog nutrition. As complete diets are now being fed for the whole of a dog's life, more detailed information is required. Some recent studies and advances are reviewed, including the role biotechnology may play in the nutrition and well being of the dog.

INTRODUCTION

There are many aspects of canine nutrition in which biotechnology may assist. Biotechnology as applied commercially to animals, however, is a relatively young industry. Although extensive nutritional and physiological studies of dogs have been conducted within the pet food industry, very little of the data has been released, as it is generally considered proprietary. As a result, despite a growing market for dog foods both in the United States and the United Kingdom, scant information has been available to the dog nutritionist to assist in the design of diets and feeding strategies. This lack of detailed information and the contradictory and changing published nutritional standards from such learned bodies as the NRC (1974, 1985) have resulted in the flush of "dry complete dog" diets appearing in the marketplace that in some instances fail to meet the nutrient requirements of the dog. Further, many unsuitable levels of certain nutrients, raw materials, trace elements, and so forth are found in such diets.

As yet there has been little or no attempt to enhance these diets or the dog's well being through the use of biotechnological products such as bacteria or yeast cultures. Enzymes, however, have been used to pre-digest raw materials. Acidification and buffers have also long been used, but as preservatives of the semi-moist foods rather than as tools to enhance utilization.

Many of the recently published requirements (NRC, 1985) are the result of work with synthetic diets, each considering a particular minimum nutrient requirement in isolation. Given the extent to which complete diets are now being fed, it is essential to review nutrient requirements in the context of the diet as a whole in addition to its specific composition. The condition of the dog in terms of sex, age, breed, stress level, etc., also becomes relevant when we are trying to optimise nutrition for health, performance, and longevity of life. This paper does not intend to review the basic nutrition of the dog, as this has been adequately covered by a number of texts (NRC, 1974, 1985; Leibetseder, 1985). However, these publications can be considered only as the broad technical basis for the formulation of dog foods. NRC (1974) is still regarded as the reference of choice due to its inclusion of safety margins. However, there are many more complex aspects to dog nutrition not covered or highlighted in such texts. The wealth of recent information through comparative studies can provide us with more detailed knowledge of dog nutrition.

THE MARKET PLACE

The market for dog foods has steadily increased both in real terms and in relation to dog numbers (Figures 1 and 2). The increase in generic, complete dog food use in the United Kingdom is primarily due to the feed compounder's desire to increase dry pelleted, extruded, or coarse mix feed production in a declining large animal marketplace. The other main attraction for the compounder has been the potentially high profit margins that can be achieved with pet foods. The success of the dry diet as produced by the compounder rather than by the specialised pet food trade has only succeeded, however, as a result of the general trend towards dry complete diets (Figure 3). This relatively rapid change in feeding strategy has arisen due to the economic situation of the kennel owner and the steadfast promotion of superior nutrition by the specialised dry pet food manufacturers. More and more puppies have thus been raised on and become accustomed to dry food.

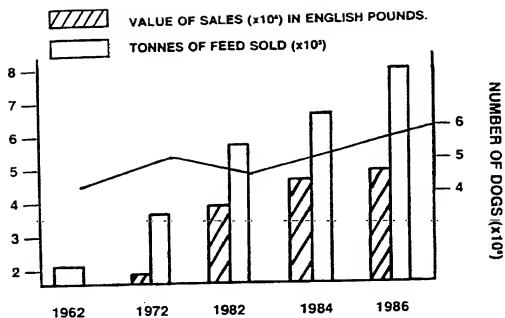


Figure 1. The dog food market in the United Kingdom.

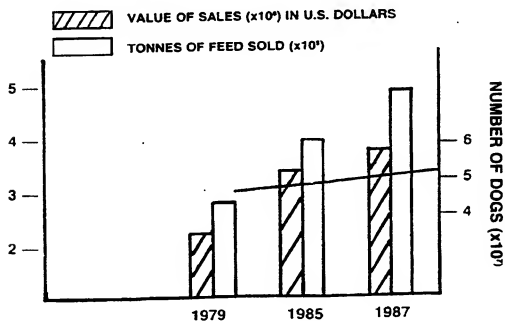
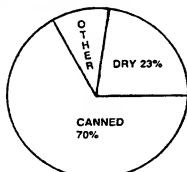
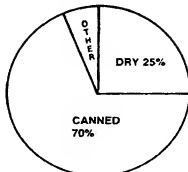


Figure 2. The dog food market in the U. S. A.

UNITED KINGDOM 1981

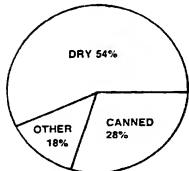


1986 (EST.)



U.S.A.

1981



1987

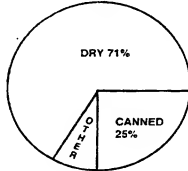


Figure 3. Dog food volume trends in the United Kingdom and U.S.A.

It is interesting to consider the lack of published information on dogs. Despite a rapid escalation of pet numbers in the last thirty years, support for research in public institutions has not been generated, as it has been with pigs and dairy cows. It would appear that the assignment of human qualities to pets has placed the dog in a different socio-economic niche from other farm animals. Expenditure by owners has been based, historically, less on economics and more on applying the "best" nutritional standards to their dog. The dog is considered to deserve the "best," as perceived by the owner. It could be said that the English attitude to pets has gone too far in that in True British fairness we have not only 6 million dogs in the UK but also 6 million cats (HMSO, 1988), one for each dog to chase! Some say that dogs are better fed than we are. Since overnutrition and obesity are now probably the main nutritional concerns in the western world in both humans and pets, it may be valid to suggest that the status of a country's population is reflected in that of its domestic pets.

Extensive advertising of commercial dog foods has thus had a greater impact on a product's sales than has the nutritional excellence of the diet. It could be suggested that while marketing will remain the most powerful of tools for the transfer of information and buying motives to the pet owner, it must now be the role of every nutritionist concerned with the production and design of dog foods to educate the pet owner. The nutritionist must ensure that the diets

are balanced, nutritionally adequate, not in excess, and that the health and well being of the dog are maximised. This latter aspect is justification itself for the application of biotechnology to dog nutrition.

We must not follow the route intimated by Ruskin (1819-1900): "There is hardly anything in the world that some man cannot make a little worse and sell a little cheaper, and the people who consider price only are this man's lawful prey." The dog owner, because he demands "The Best" for his dog, relies on the nutritionist and the dry complete diet to supply just that. This position is easily open to abuse, as illustrated by Corbin (1986). It is thus now essential to consider both economics and the techniques available to meet the requirements of the dog effectively.

ENERGY AND PROTEIN REQUIREMENTS

A number of workers (Manner et al., 1987; Booles and Rainbird, 1987) have recently re-examined the energy requirements of dogs, based on conventional factors and direct measurements. This, together with experimental values of Rainbird (1987) and Leibetseder (1987), helps to relate the requirements for energy, protein and minerals to body weight for a wide range of breed sizes. Dose response work by Leibetseder (1987) also gives values for trace elements and vitamins.

While extensive work has been carried out at the University of Illinois on protein requirements as indicated by Corbin (1988), information on the requirements for specific amino acids for individual breeds is still not plentiful. This is cause for concern, as both Blaza et al. (1982) and Hirakawa and Baker (1985) have demonstrated breed differences in requirements. Amino acid imbalances, as well as deficiencies, can be detrimental to growth rates. Indeed, an excess of methionine tends to be toxic as is excess of lysine and cysteine (Tables 1 and 2). Further, lysine-antagonized arginine reduced weight gains in Pointers (Czarnecki et al., 1985). These comparative studies, however, begin to give some indication of the utilization and correct balance of amino acids that are required in the dog. This at least draws attention to the potential problems as well as providing some of the answers.

TABLE 1. RESPONSE OF PUPPIES FED DIETS CONTAINING VARYING RATIOS OF METHIONINE TO CYSTEINE

L-methionine	L-cysteine	Total sulfur amino acids	Gain (g/day)	Gain:feed (g/kg)
g/kg diets				
2.250	2.250	4.5	78.7 ^a	420 ^a
1.125	3.375	4.5	14.3 ^b	114 ^b
1.125	1.125	2.25	21.2 ^b	158 ^b
Pooled SEM			8.9	28

^{a,b} Means with different superscripts are significantly different for weight gain (P<.005) and gain:feed (P<.001).

TABLE 2. REPLACEMENT VALUE OF CYSTEINE FOR METHIONINE*

L-methionine (g/kg diet)	L-cysteine	Cysteine (% of SAA)	Gain (g/day)	Gain:feed (g/kg)
4.500	0	0	66.7 ^a	537 ^a
3.375	1.125	25	68.9 ^a	530 ^a
2.250	2.250	50	55.8 ^a	479 ^a
1.125	3.375	75	2.9 ^c	51 ^c
Pool SEM			7.5	20

* Hirakawa and Baker (1985).

^{a-c} Means with different superscripts are significantly different ($P < 0.001$).

NUTRITIONAL AND INTESTINAL DYSFUNCTION

Dogs are increasingly suspected of having food allergies. Generally speaking, the symptoms are associated with salivation, vomiting, and diarrhoea. The allergy may also manifest itself on the skin (Greiffenhagen-Potocki, 1978). The dietary ingredients or their metabolites which in turn provide the nutrients essential for growth also evidently can become potential allergens (Porter and Barratt, 1987). Because the dry complete diet allows the nutritionist more flexibility in raw material choice, a wider range of materials also are examined as a function of cost. The allergenicity of raw materials must now be carefully considered.

Metabolic problems as a result of dietary hypersensitivity may lead to infection with opportunistic pathogens. *E. coli*, with its rapid specific growth rate, will always try to dominate the intestinal tract. Treatment with probiotics in such a situation could be beneficial. For example, the ability of *E. coli* to decarboxylate basic amino acids to form putrefactive amines is reduced by lactobacilli (Hill et al., 1970).

Enhancing the beneficial microbial population in the intestine is known to help immune response in a variety of ways at the cellular level. Increased levels of vitamin E have also been shown beneficial to immune response through enhanced antigen-specific B cells and T "helper" cells (Porter and Barratt, 1987).

Tactically there are not many ways of countering dietary hypersensitivity, because comparatively little is known about allergens. Avoidance of specific feeds, such as soya (Kilshaw and Sissons, 1979), is by far the most effective means, unless one can use a product where immunologically characterised antigens have been removed, such as sycamil, for example (Smith and Sissons 1975). Another option is to deactivate such agents by processing methods, heat treatment, or acidification.

In addition to individual sensitivity to particular foods, the following factors are also of significance in the occurrence of food allergies: a reduced efficiency

of the digestive tract as a result of age or infection, a defective pancreas, inadequate detoxification by the liver, and parasite infection.

Many foods have been demonstrated to produce allergenic reactions in dogs, e.g., eggs, fish, soya, and milk. However, it must be said that in the case of milk it is often a lactose intolerance through enzyme deficiency rather than a true allergy. There may also be a breed-related increase in incidence and a hereditary predisposition to food allergies. Boxers, for example (Greiffenhagen-Potocki, 1978), appear more susceptible to allergy than Labradors.

FOOD COMPOSITION

The raw materials used in a diet, irrespective of the allergenic activity, can have an influence on intestinal flora in the dog. There are two main areas for concern where diet design and biotechnology have a major role to play. First, a change in intestinal flora reduces digestive efficiency and causes the possible antisocial problem of flatulence as the undigested portion of the diet is fermented in the colon. Secondly, this reduced digestive efficiency reduces the proliferation of potentially harmful bacteria. In a typical healthy dog the intestinal microflora is in eubiosis in the proportion indicated (Table 3). The vast majority of the microorganisms are found in the large intestine with relatively low numbers in the ileum. Variations in these proportions can occur as a function of age, or as a result of diet composition, quantity and digestibility (Table 4).

TABLE 3. COMPOSITION OF FAECAL FLORA OF 13 CLINICALLY HEALTHY DOGS (3 TO 42 MONTHS)*

Microorganisms	Average log count	Frequency of detection
Total bacterial count	10.8	100
Bacteriodaceae	10.3	100
Catena bacteria	9.9	100
Peptostreptococci	9.6	100
Bifidobacteria	9.2	100
Streptococci	9.9	100
Enterobacteriaceae	8.1	100
Lactobacilli	9.6	100
<i>Clostridium perfringens</i>	5.6	61.5
Other clostridia	9.0	38.5
Staphylococci	3.7	84.6
Yeasts	3.4	30.8

* From Amsberg et al. (1978).

TABLE 4. VARIATION IN FAECAL FLORA IN DOGS AS A FUNCTION OF AGE AND DIET^a

Log count	Age		Diet	
	0-18 days	Adult	Basic ^b	Test ^c
<i>E. coli</i>	0-9.9	7.5	—	10 ⁷ to 10 ¹⁰
<i>C. perfringens</i>	0-8.9	8.4		
Streptococci	0-9.0	7.6		
Bacteriodes	0-10.0	8.7		
Lactobacilli	9.3	4.6		

^a Amtsberg et al. (1978).^b Basic diet: casein, corn starch, beef, and pork dripping.^c Test diet: muscle:meat, liver, and egg protein.

Torrey, as early as 1919, pointed out the association between feeding meat and an increase in the numbers of *Clostridium perfringens* in the faeces. This is important for its pathogenesis in nutritionally-induced digestive disorders. *Clostridium perfringens* possesses proteolytic properties. Thus, by deamination it can release ammonia from free amino acids or can form biogenic amines by decarboxylation. These in turn can cause detrimental effects on processes in the intestine and on intermediary metabolism, e.g., fluid absorption in the large intestine. As a result of clostridia predominating in the ileum and caecum, deconjugation of bile acids can be expected, again upsetting fluid and electrolyte balance and reducing fat absorption (Guggenbichler and Stickler, 1975). Finally, certain strains of *Clostridium perfringens* type A are capable of forming an enterotoxin in the intestine (Duncan and Strong, 1969). They are also one of the causes of food poisoning in humans.

Clearly the avoidance of excessive meat intake is one way of reducing the level of clostridia in faeces. The regular supply of streptococci and lactobacilli via the diet have also been shown to depress fecal counts of *E. coli* and clostridia in dogs (J. A. Lowe, unpublished data).

Meyer et al. (1978) reviewed the general pattern of the pathogenesis of alimentary disorders in dogs. They concluded any ration which is difficult to digest or which is incompletely digested as a dysfunction of the alimentary canal makes the dog susceptible to intestinal disorders. The products of incomplete digestion are rapidly fermented by microbes in the large intestine, producing effects varying in severity from mild flatulence to pronounced diarrhoea.

The dog has only a few effective mechanisms to prevent such bacterial upsets. The wild canine carnivores' "natural diet" consists mainly of highly digestible proteins and fats, with only small proportions of indigestible components such as vegetable fiber or keratin. These residues are only partially decomposed by the microflora of the intestine. They do however, have a high rate of passage through this area so as to reduce the risk of dysfunction as a result of microbial fermentation.

In the modern dry complete dog diet, raw materials and/or processing methods must be chosen to minimise any undesirable reaction of the diet within the intestinal tract. The use of highly digestible proteins or the predigestion of feeds via enzymes and acidification prior to their inclusion in the diet, have proven to be effective. Micronisation and extrusion processing, for example, have been shown to improve the digestibility of fiber and carbohydrates (Bjonck et al., 1984; Meyer and Heckötter, 1985; Table 5).

TABLE 5. EFFECT OF COOKING ON DIGESTIBLE ENERGY VALUES OF CARBOHYDRATES*

	Digestible energy (MJ/kg)	
	Raw	Cooked
Wheat	13.8	15.6
Maize	13.3	15.3
Barley	13.2	15.4
Oats	13.2	16.3
Potatoes	2.0	3.3
Potato starch	3.1	14.0
Maize starch	7.8	14.1

* Meyer et al. (1978).

Carbohydrates, although not an integral part of the natural diet and not considered essential (NRC, 1974; Kronfield, 1977), have been shown to be important for optimum reproductive performance (Romsos et al., 1981) and growth (Resnick, 1978). Although the latter findings have yet to be repeated by other workers, the use of carbohydrate in the form of cereals in dog diets remains commonplace, mainly as a function of economics and convenience.

The use of properly processed cereals, together with essentially inert products such as cellulose or keratin, gives the nutritionist the opportunity to design diets that will give the impression of gut fill while reducing energy input. This approach is important in the feeding of the clinically obese (Lewis, 1977) and in the treatment of some behavioral problems (Mugford, 1987).

Individual foodstuffs can have a dramatic effect upon the dog as a result of their influence on the intestinal flora (Amsberg, 1987). Some of the observed effects appear to be a result of the raw material itself, e.g., lactose, while others act in combination. It has been demonstrated that the inclusion of low digestibility carbohydrates reduced the digestibility of meat meal in the diet. Klocke et al. (1987) found that soya bean meal with tapioca starch produced more gas than soya bean plus rice. Similar reports were given by Schünemann and Ingmenser (1987). Fats, on the other hand, appear to be readily digested by dogs and the digestive capacity rarely exceeded. Use of such products as yeast cultures are now being shown to be beneficial not only

to the digestive efficiency of the dog, associated with reduced flatulence and improved faecal consistency, but also to general well being and coat condition (J. A. Lowe, unpublished data, 1988).

VITAMIN AND TRACE ELEMENT SUPPLY

It has long been noted that biotin and zinc have an effect on coat condition and general health and that hair is an important indication of mineral status. (Combs, 1987). More recently, Sanecki, Corbin and Forbes (1985) have shown the need for zinc and the reversible and complete remission of the symptoms of zinc deficiency when 200 mg/kg zinc carbonate was added to diets. Other studies have shown increased symptoms of zinc deficiency with elevated levels of calcium, a common finding in many dry diets based on meat and bone meal.

Yeast culture has been shown to enhance mineral uptake and utilization (Petersen et al., 1987). Yea-Sacc (Alltech, Inc.) has been demonstrated as an effective source of zinc and biotin, thus indicating its usefulness in dog diets.

The feeding of the young and growing puppy is an area fraught with difficulty for the nutritionist because of the insistence by many owners and breeders upon adding to an already balanced diet and to overfeed the said diet. Alexander and Wood (1987) indicated that careful time-restricted feeding of the puppy is to be advocated. Hazelwinkel et al. (1987) recommended the avoidance of a high calcium intake, with or without a constant calcium to phosphorus ratio, to minimize abnormal skeletal development. Yet many persist in the addition of bone meal to the diet.

Excessive use of vitamin C can also lead to upsets in the hormonal balance and excess calcium deposition as a result (Bennett, 1987). Yet many persist in its use to prevent osteochondrosis, a completely unproven effect.

The iron requirement of growing English pointer puppies was established by Chausow and Czarnecki-Maulder (1987) at 80 mg per kg of diet. The supply of this iron via a commercially available source of lactoferrin could be seen as a logical approach. Although the bacterial population in the puppy is established within the first two days of life and is predominately lactobacilli promoted by the milk diet, both dietary changes and stress situations abound over the next eight to 12 weeks. Lactoferrin could act here not only as a source of iron but also with a bacteriocidal action in the puppy, thus helping to prevent digestive problems as a result of stress-induced changes in intestinal microflora. It would appear from Lavelle (1987) that the addition of vitamin D to the diet is essential for the dog.

Vitamin E deficiency may well be aggravated by hypervitaminosis A. Loew (1987) reported that dogs mildly deficient in vitamins A and D apparently suffer fewer problems than with hypervitaminosis A. Revision of the addition of vitamins A and particularly E (Rice, 1988) may be required and of benefit to the dog.

CONCLUSIONS

There appears now to be a steadily increasing number of comparative studies published on the requirements of the dog that, at least in part, provide us with better information and values for the levels of nutrients needed both in isolation and in conjunction with other dietary ingredients.

The role of biotechnology in dog nutrition is still minimal, yet the opportunities abound. However, little research data is available to support the theory. Practical results in dogs in the UK, however, are beginning to encourage the products' use in the commercial world.

With yeast cultures for coat condition, health, and improved digestive efficiency and probiotics for the young pup, stressed, elderly, or sick dogs, biotechnology must soon become a part of the dog nutritionist's research program.

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Exhibit G



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PRODUCT REFERENCE MANUAL

 **LabDiet**

Product Code Number	Product Description	Page
5001	Laboratory Rodent Diet	S-1
5002	Certified Rodent Diet	C-1
5003	Laboratory Feline Diet	S-22
5006	Laboratory Canine Diet	S-23
5007	Certified Canine Diet	C-2
5008	Formulab Diet	S-4
5010	Laboratory Autoclavable Rodent Diet	S-5
5012	Rat Diet	S-6
5013	Autoclavable Rodent Breeder Diet	S-7
5014	Certified Autoclavable Rodent Diet	C-3
5015	Mouse Diet	S-8
5020	Mouse Diet 9F	S-9
5021	Autoclavable Mouse Diet	S-10
5025	Guinea Pig Diet	S-11
5026	Certified Guinea Pig Diet	C-4
5037	Monkey Diet Jumbo	S-12
5038	Monkey Diet	S-12
5040	New World Primate Diet	S-13
5041	TestDiet™ Marmoset Jelly	T-1
5045	High Protein Monkey Diet	S-14
5047	High Protein Monkey Diet Jumbo	S-14
5048	Certified Primate Diet	C-5
5049	Laboratory Fiber-Plus® Monkey Diet	S-15
5050	Laboratory Fiber-Plus® Monkey Diet Jumbo	S-15
5052	Fiber-Balanced Monkey Diet	S-16
5053	PicoLab® Rodent Diet 20	I-1
5058	PicoLab® Mouse Diet 20	I-2
5060	Fly Larvae Media	S-17
5061	Pico-Vac® Lab Rodent Diet	I-3
5062	Pico-Vac® Mouse Diet 20	I-4
5065	Laboratory Chick Diet S-G	S-18
5070	Laboratory Cage Layer Diet	S-19
5073	TestDiet™ Monkey MV	T-2
5080	Laboratory Mini-Pig Starter Diet	S-20
5081	Laboratory Mini-Pig Grower Diet	S-21
5082	Laboratory Mini-Pig Breeder Diet	S-22
5084	Laboratory Porcine Diet Grower	S-23
5280	Ferret Diet	S-24
5304	Autoclavable Rabbit Diet	S-26
5321	Laboratory Rabbit Diet	S-18
5322	Certified Rabbit Diet	C-6
5325	Certified High Fiber Rabbit Diet	C-7
5326	Laboratory Rabbit Diet HF	S-27
5508	Rumilab® Diet	S-28
5755	Basal diet	T-3
5800	AIN-76 Semi-Purified Diet, Rat or Mouse	T-4
5800-B	AIN-76A Semi-Purified Diet, Rat or Mouse	T-5
5801-G	AIN-93G Growth Semi-Purified Diet	T-6
5801-M	AIN-93M Maintenance Semi-Purified Diet	T-7
5894	Purified Diet for Primates	T-8

Product Code Number	Product Description	Page
5K91	Certified Hi-Fiber Primate Diet	C-8
5K92	Pico-Vac® Rodent Soft Mix	T-9
5K93	TestDiet™ Aquatic Mix	T-10
5K94	Low Residue Canine Surgery Mix	T-11
5L14	High Density Ferret Diet	S-29
5L18	Laboratory High Density Canine Diet	S-30
5L36	Certified Rodent Opti-Diet	C-9
5L80	LabDiet® Mini-Pig HF Grower	S-31
5P00	ProLab® RMH 3000	S-32
5P04	ProLab® RMH 3500, Autoclavable	S-33
5P06	ProLab® RMH 2000	S-34
5P07	ProLab® RMH 1000	S-35
5P14	ProLab® RMH 2500	S-36
5P18	ProLab® Guinea Pig	S-37
5P25	ProLab® Hi-Fiber Rabbit	S-38
5P26	ProLab® Rabbit Diet	S-39
5P40	ProLab® Canine 1600	S-40
5P41	ProLab® Canine 2000	S-41
5P46	ProLab® Primate 18	S-42
5P75	ProLab® Isopro® RMH 3000, Irradiated, Vacuum Packed 6.5# Boxes	I-5
5P76	ProLab® Isopro® RMH 3000, Irradiated, 25#	I-6
5P94	ProLab® Mini-Pig Diet	S-43
5R24	ProLab® RMH 2500, Autoclavable	S-44
9256	TestDiet™ Papaya Tablet	T-14
9257	TestDiet™ Papaya Tablet	T-14
9258	TestDiet™ Monkey Mini MV Tablet	T-12
9259	TestDiet™ Monkey Mini MV Tablet Plus Iron	T-13
9262	TestDiet™ Papaya Tablet	T-14
9267	TestDiet™ Purified Reward Tablet	T-15
9268	TestDiet™ Purified Reward Tablet	T-15
9269	TestDiet™ Purified Reward Tablet	T-15
LD 101	PMI® Micro-Stabilized Rodent Liquid Diet	T-16
LD 101A	PMI® Micro-Stabilized Alcohol Rodent Liquid Diet	T-17
LD 102	PMI® Rodent Liquid Diet	T-18
LD 102A	PMI® Alcohol Rodent Liquid Diet	T-19
LD 104	PMI® Maltodextrin	T-20
LD 304	PMI® Micro-Stabilized Rabbit Liquid Diet	T-21
LD 304A	PMI® Micro-Stabilized Alcohol Rabbit Liquid Diet	T-22

Animal Care and Biological Values	
A-1 - A-24	Nutrition
N-1 - N4	Summary of Diets
SD-1 - SD9	Shelf Life Information
SL-1 - SL-5	TestDiet™ Information
T-1 - T-XIX	Custom/Modified Conventional TestDiet™ Products
T-TT - T-VII	Comparative Research
T-VII - T-XI	PMI® Purified TestDiet™
T-XII - T-XIX	TestDiet™ Tablet Information
T-XX	

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DESCRIPTION

Laboratory Canine Diet is a constant-nutrient formula supplying complete canine life-cycle nutrition for reproduction, lactation, growth and maintenance. This palatable high-protein, high-energy diet, made with a constant formula, is recommended for minimizing nutritional variables in long-term studies. Refer to the Shelf Life section at the end of this book for product longevity information and storage suggestions.

Features and Benefits

- Constant-nutrient formulation, minimizes nutritional variables in long-term studies
- Highly digestible diet helps increase efficiency and economy
- Designed for low fecal volume and firmer stools
- Provides high plane of nutrition that helps animals withstand stress

Product Forms Available

- Chunk, 16 mm(5/8") x 8 mm(5/16")
- Meal (ground chunks)

GUARANTEED ANALYSIS

Crude protein not less than	25.0%
Crude fat not less than	9.0%
Crude fiber not more than	4.0%
Moisture not more than	12.0%
Ash not more than	10.0%
Added minerals not more than	2.0%

INGREDIENTS

Ground yellow corn, soybean meal, meat meal, ground wheat, corn gluten meal, wheat middlings, animal fat preserved with BHA, dried beet pulp, dried whey, wheat germ meal, brewers dried yeast, fish meal, calcium carbonate, salt, vitamin A acetate, cyanocobalamin, cholecalciferol, D-alpha tocopheryl acetate, menadione dimethylpyrimidinol bisulfite (source of vitamin K), choline chloride, biotin, folic acid, nicotinic acid, calcium pantothenate, pyridoxine hydrochloride, sodium selenite, riboflavin, thiamine mononitrate, manganous oxide, ferrous sulfate, copper sulfate, cobalt carbonate, zinc oxide, calcium iodate.

FEEDING DIRECTIONS

Due to the variation in dog breeds used for research purposes, the feeding directions given are for the Beagle. For dogs the size of Beagles, the feed consumption is normally 20-30 grams of air-dry Laboratory Canine Diet per kilogram of body weight. Smaller breeds consume slightly more in proportion to body weight, while larger breeds consume slightly less. Laboratory Canine Diet can be fed moistened with water, milk or broth, if desired. If fed dry, it can be offered free choice in self feeders. For growing pups, feed free-choice. Most pups will start to eat solid food at three to four weeks of age. Sometimes pups eat better if the feed is moistened.

CHEMICAL COMPOSITION¹

Nutrients ²	Sulfur, %
Protein, %	25.5
Arginine, %	1.46
Cystine, %	0.37
Glycine, %	1.85
Histidine, %	0.55
Isoleucine, %	1.02
Leucine, %	2.10
Lysine, %	1.10
Methionine, %	0.44
Phenylalanine, %	1.09
Tyrosine, %	0.74
Threonine, %	0.90
Tryptophan, %	0.25
Valine, %	1.15
Serine, %	1.20
Aspartic Acid, %	2.55
Glutamic Acid, %	4.94
Alanine, %	1.68
Proline, %	2.07
Taurine, %	<0.01
Fat (ether extract), %	8.5
Fat (acid hydrolysis), %	9.5
Cholesterol, ppm	167
Linoleic Acid, %	1.32
Linolenic Acid, %	0.08
Arachidonic Acid, %	0.01
Omega-3 Fatty Acids, %	0.09
Total Saturated Fatty Acids, %	3.66
Total Monosaturated Fatty Acids, %	3.40
Fiber (Crude), %	2.8
Neutral Detergent Fiber ³ , %	11.1
Acid Detergent Fiber ⁴ , %	4.1
Nitrogen-Free Extract (by difference), %	45.0
Starch, %	33.5
Glucose, %	0.23
Fructose, %	0.23
Sucrose, %	1.08
Lactose, %	0.46
Total Digestible Nutrients, %	83.1
Gross Energy, kcal/gm	4.33
Physiological Fuel Value ⁵ , kcal/gm	3.68
Metabolizable Energy, kcal/gm	3.54

Vitamins

Carotene, ppm	2.0
Vitamin K (as menadione), ppm	0.28
Thiamin Hydrochloride, ppm	10
Riboflavin, ppm	4.5
Niacin, ppm	78
Pantothenic Acid, ppm	20
Choline Chloride, ppm	2000
Folic Acid, ppm	2.8
Pyridoxine, ppm	13
Biotin, ppm	0.18
B ₁₂ , mcg/kg	27
Vitamin A, IU/gm	40
Vitamin D ₃ (added), IU/gm	4.4
Vitamin E, IU/kg	44
Ascorbic Acid, mg/gm	—

Calories provided by:

Protein, %	27.755
Fat (ether extract), %	23.265
Carbohydrates, %	48.980

*Product Code

1. Based on the latest ingredient analysis information. Since nutrient composition of natural ingredients varies, analysis will differ accordingly.
2. Nutrients expressed as percent of ration except where otherwise indicated. Moisture content is assumed to be 10.0% for the purpose of calculations.
3. NDF = approximately cellulose, hemicellulose and lignin.
4. ADF = approximately cellulose and lignin.
5. Physiological Fuel Value (kcal/gm) = Sum of decimal fractions of protein, fat and carbohydrate (use Nitrogen Free Extract) x 4.9, 4 kcal/gm respectively.

Exhibit H

United States Patent [19]

Matsuura et al.

[11] Patent Number: 5,756,088

[45] Date of Patent: May 26, 1998

[54] PRESCRIPTION DIET COMPOSITION FOR TREATMENT OF DOG AND CAT DERMATOSIS

[75] Inventors: Ichiro Matsuura, Tokyo; Toshizumi Saito, Musashimurayama; Kenjiro Shimada, Tsuchiura, all of Japan

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[21] Appl. No.: 532,389

[22] Filed: Sep. 22, 1995

Related U.S. Application Data

[63] Continuation of Ser. No. 186,549, Jan. 26, 1994, abandoned.

[30] Foreign Application Priority Data

Jan. 27, 1993 [JP] Japan 5-011984

[51] Int. Cl.⁶ A01N 63/02

[52] U.S. Cl. 424/93.4; 424/93.1; 424/93.41; 424/93.44; 424/93.45; 424/93.46; 424/439; 424/442; 426/2; 426/61

[58] Field of Search 424/93.1, 93.4, 424/93.41, 93.44, 439, 442, 93.46, 93.45; 426/2, 805; 514/861

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[57] ABSTRACT

The present invention provides a prescription diet composition containing a poly-unsaturated fatty acid such as γ -linolenic acid, α -linolenic acid and docosahexaenoic acid, and/or biotin, and an antiflatulent such as a lactic acid bacterium, a Bifidobacterium, a butyric acid bacterium or a Bacillus. The prescription diet composition is useful for the prevention and treatment of dog and cat dermatosis.

8 Claims, No Drawings

PRESCRIPTION DIET COMPOSITION FOR TREATMENT OF DOG AND CAT DERMATOSIS

This application is a continuation application of Ser. No. 08/186,549 filed Jan. 26, 1994, now abandoned.

BACKGROUND OF THE INVENTION

The present invention relates to a prescription diet composition having prophylactic and therapeutic effects against dermatosis of pet animals.

Recently, along with longer life spans of pet animals as a result of improvement in veterinary medicine and the trend toward Europeanization of pet food, as well as the unnatural breeding environment of pet animals without regard to their nature, increase in the incidence of adult diseases and diseases caused by metabolism disorders of pet animals has increased.

Among these diseases, dermatosis is outwardly observable. Dermatitis easily becomes chronic, and often requires long-term treatment.

The treatment of dermatosis usually involves intramuscular or subcutaneous injection, oral administration or external application of antibacterial agents, steroids and the like. However, dermatosis is usually difficult to cure in a short period of time with the drugs alone. Moreover, long-term administration of the drugs often results in occurrence of side effects such as secondary adrenal cortical hypofunction, gastrointestinal disorders such as ulcers and bleeding, nephrotoxicity and chill of the infection.

It is known that since deficiency of essential fatty acids and biotin is the main cause of canine dermatosis, incorporation of such ingredients into pet foods is effective against canine dermatosis [Fromageot, D. et al., Rec. Med. Vet. 158, (12), 821-826, 1982]. Also, in cats a severe deficiency of Δ -6-desaturase inhibits the conversion of linoleic acid into γ -linolenic acid, and incorporation of γ -linolenic acid into pet foods is known (Japanese Published Unexamined Patent Application No. 149054/86). Furthermore, the activity of Δ -6-desaturase in dogs is clearly attenuated by aging and diseases such as hepatic diseases and diabetes (Wolter, R. R., Wolter's Canine and Feline Nutrition Science, p.71, published by Nihon Rinsho Co., 1991), and thus the incorporation of poly-unsaturated fatty acids such as dihomo γ -linolenic acid, arachidonic acid, eicosapentaenoic acid, γ -linolenic acid and the like into canine and feline pet foods is known (Japanese Published Unexamined Patent Application No. 215245/89). Nevertheless, the effect of such pet foods is not yet satisfactory from the point of view of the prophylactic or therapeutic treatment of canine and feline dermatosis.

The use of antifilutants for the purpose of prevention and treatment of diarrhea and loose passage is known (Japanese Published Unexamined Patent Application No. 118827/76, etc.), but their use for the purpose of prophylactic or therapeutic treatment of pet dermatosis is not known.

SUMMARY OF THE INVENTION

An object of the invention is to provide a prescription diet composition for pet animals, which comprises an antifilutent; and at least one of poly-unsaturated fatty acid and biotin. Another object of the present invention is to provide a method for prophylactic or therapeutic treatment of dermatosis in a pet animal which comprises having the pet animal ingest the prescription diet composition.

DETAILED DESCRIPTION OF THE INVENTION

The poly-unsaturated fatty acid to be contained in the prescription diet composition of the present invention includes, for example, an ω -3- or ω -6-type essential fatty acid. Particularly preferred are γ -linolenic acid, α -linolenic acid, eicosapentaenoic acid, docosahexaenoic acid (hereinafter referred to as DHA), etc. The γ -linolenic acid, α -linolenic acid, eicosapentaenoic acid and DHA, etc. may be originated from any source. Specifically, the γ -linolenic acid may be derived from evening primrose oil, a microorganism belonging to the genus *Mortierella* or *Mucor*, an algae belonging to the genus *Euglena* or *Chlorella*, or from extracts thereof. The α -linolenic acid may be derived from seeds of plants such as *Perilla ocimoides* var., *Perilla crispa ocimoides*, L., Linseed, rape seeds, soybean, etc. or from extracted oils thereof. The eicosapentaenoic acid and DHA may be derived from the oils of fishes such as sardines, bonito and tuna, from a microorganism belonging to the genus *Mortierella*, etc. or from extracted fluids thereof. The poly-unsaturated fatty acid to be contained in the prescription diet composition of the present invention may be in a free form or in the form of a salt or ester. The salt may be a non-toxic metal salt, for example, sodium salt, potassium salt and calcium salt, and the ester includes, for example, methyl ester, ethyl ester or the like.

The biotin, or vitamin H, to be contained in the prescription diet composition of the present invention may be either synthesized or extracted from a yeast, a microorganism belonging to the genus *Bacillus*, *Escherichia* or *Corynebacterium*, a plant, an animal organ, or a Chinese herbal medicine such as *jumi-haidokoto*, *sofusuan* and *toki-inshi*.

The antifilutent to be contained in the prescription diet composition of the present invention comprises materials having an action of suppressing the growth of harmful intestinal bacteria and/or of accelerating the growth of beneficial intestinal bacteria. For example, cells of a bacterium selected from lactic acid bacteria such as *Lactobacillus acidophilus*, *Streptococcus faecalis*, *Lactobacillus bulgaricus*, *Lactobacillus casei*, etc.; *Bifidobacterium* such as *Bifidobacterium bifidum*, *Bifidobacterium longum*, *Bifidobacterium breve*, *Bifidobacterium adolescentis*, *Bifidobacterium pseudolongum*, *Bifidobacterium thermophilum*, etc.; butyric acid bacteria such as *Clostridium butyricum*, etc.; *Bacillus* such as *Bacillus natto*, *Bacillus cereba toyoi*, and the like, as well as treated cells of the bacterium are mentioned. The treated cells include, for example, washed cells, dry cells, freeze-dried cells, acetone-dried cells, organic solvent-treated cells, surfactant-treated cells, lysozyme-treated cells, ultrasonically treated cells, mechanically disrupted cells, or the like.

The pet animals which may ingest the prescription diet composition of the present invention include small domestic animals such as dogs and cats.

The concentration of the poly-unsaturated fatty acid in the prescription diet composition of the present invention is 0.5-50 wt %, preferably 1-25 wt %. The concentration of the biotin is 0.01-1.0 wt %, preferably 0.04-0.4 wt %. The concentration of the antifilutent is 10^6 - 10^{10} cells/per gram of the prescription diet composition (0.00001 to 10 wt % when calculated as dry cell weight).

In addition to the above-mentioned active ingredients, inactive auxiliary agents may be contained in the prescription diet composition. In order to enhance the effect of the antifilutent, oligosaccharides such as fructo-

oligosaccharide, soybean oligosaccharide, xylooligosaccharide, inulooligosaccharide and lactulose may be added. Also, amino acids such as methionine and taurine; vitamins such as vitamin A, vitamin B₂, vitamin B₆ and nicotinic acid; and zinc, which are known to be effective in treating dermatosis, may be added. Furthermore, for a nutritional standpoint, yeast extract, dry milk, proteins, enzymes, inorganic substances such as calcium, magnesium and phosphorus, nucleic acids, and essential fatty acids such as linolic acid may be added. For good taste, salts such as sodium chloride, organic acids and sweeteners such as sugar may be added; for the purpose of formulation of the prescription diet composition, emulsifiers such as enzymolytic lecithin, excipients such as lactose, cyclodextrin, grains, starch and calcium carbonate may be added; and for stability during transportation and storage, antioxidants such as vitamin E, β -carotene, vitamin C and lecithin may be added.

The concentration of these inactive ingredients in the prescription diet composition of the present invention is 0-99.99 wt %, preferably 5-95 wt %.

The prescription diet composition of the present invention may be used in combination with dermatotherapeutic medicines such as antibacterial agents (e.g. lincomycin), antipruritic agents (e.g. prednisolone), analgesics (e.g. salicylic acid), antiinflammatory agents (e.g. prednisolone), antiallergic agents (e.g. hydramine) and adrenal cortical hormone preparations (e.g. prednisolone), for the purpose of heightening the therapeutic effects of these medicines.

The prescription diet composition of the present invention may be ingested by a pet animal in the form of a powder, granules, pellets, tablets, a paste, an aqueous solution, or the like, either alone or as a mixture with feeds for pet animals.

The amount of intake of the prescription diet composition of the present invention per animal per day is preferably 0.1 g-2.5 g for pet animals having a body weight of less than 5 kg, 0.2 g-5.0 g for pet animals having a body weight of 5 kg or between 5 and 10 kg, 0.3 g-7.5 g for pet animals having a body weight of 10 kg or between 10 and 15 kg, and 0.5 g-20 g for pet animals having a body weight of 15 kg or above. The number of intake times is not particularly restricted, so long as the desired effect is manifested, but the daily intake times are preferably divided into two or more aliquots.

Examples of daily intake amounts of the prescription diet composition of the present invention are given below.

Pet animals having a body weight of less than 5 kg

γ -linolenic acid	4-250 mg
Biotin	0.05-10 mg
<i>Bifidobacterium</i>	0.1 μ g-100 mg as dry cell weight (10^8 - 10^{10} cells per gram of the composition)

Pet animals having a body weight of 5 kg or between 5 and 10 kg.

γ -linolenic acid	8-500 mg
Biotin	0.1-20 mg
<i>Bifidobacterium</i>	0.1 μ g-100 mg as dry cell weight (10^8 - 10^{10} cells per gram of the composition)

Pet animals having a body weight of 10 kg or between 10 and 15 kg.

γ -linolenic acid	12-750 mg
Biotin	0.15-26 mg
<i>Bifidobacterium</i>	0.1 μ g-100 mg as dry cell weight (10^8 - 10^{10} cells per gram of the composition)

Pet animals having a body weight of 15 kg or above

γ -linolenic acid	20-2,000 mg
Biotin	0.25-32 mg
<i>Bifidobacterium</i>	0.1 μ g-100 mg as dry cell weight (10^8 - 10^{10} cells per gram of the composition)

Prophylactic and therapeutic effects against pet dermatosis are produced by having pet animals ingest the prescription diet composition of the present invention.

The mechanism of the prophylactic and therapeutic effect is not completely clarified. It is considered that since the intestinal bacterial flora is improved by the antifungal and, and since the orally ingested poly-unsaturated fatty acid and/or biotin are less decomposed and less assimilated in the intestine and more effectively absorbed in the intestine, improvement in metabolism of fatty acids produces prophylactic and therapeutic effects against dermatosis, etc.

The present invention is described in the following Examples, Reference Examples and Experimental Examples.

Example 1

A 420 g portion of flaky LINOX (product of Idemitsu Petrochemical Co.; dried cells of *Mucor* bacteria containing 10% γ -linolenic acid; and the same product was used in the Examples hereinafter) was finely divided in a mortar to less than 100 mesh. To the resulting granules were added 80 g of ROVIMIX H-2 (product of Nihon Roche Co.; biotin content 2%; and the same product was used in the Examples hereinafter) which had been passed through a 100 mesh sieve and 500 g of KOROLAC D (product of Nissin Flour Milling Co.; containing 10^7 cells or more of *Bifidobacterium pseudolongum* SS-24 strain per 1 gram of the product; and the same product was used in the Examples hereinafter), and the mixture was thoroughly mixed with a rocking mixer to obtain the prescription diet composition of the present invention.

Example 2

An 80 g portion of ROVIMIX H-2 which had been passed through a 100 mesh sieve, 500 g of KOROLAC D and 420 g of lactose (product of Megure Co.; the same product was used in the Examples hereinafter) were adequately mixed together with a rocking mixer to obtain the prescription diet composition of the present invention.

Example 3

The prescription diet composition was prepared by the same method as described in Example 1, except that 420 g of α -linolenic acid powder (cyclodextrin clathrate powder containing 20% α -linolenic acid) produced according to the method described in Japanese Published Unexamined Patent Application No. 41395/84 was used instead of LINOX.

Example 4

The prescription diet composition was prepared by the same method as described in Example 1, except that 80 g

of DHA powder (cyclodextrin elathrate powder containing 14% DHA) produced according to the method described in Japanese Published Unexamined Patent Application No. 41395/84 was used instead of LINOX.

Example 5

The prescription diet composition was prepared by the same method as described in Example 1, except that 500 g of "Biofermin for animals" (product of Biofermin Seiyaku Co.; 10^9 cells of *Streptococcus fecalis* and 10^9 cells of *Lactobacillus acidophilus* per 10 g) was used instead of KOROLAC D.

Example 6

The prescription diet composition was prepared by the same method as described in Example 1, except that 500 g of "Miyari cell powder for incorporation" (product of Miyarisan Co.; containing 30 mg of *Clostridium butyricum* per 1 gram of the product) was used instead of KOROLAC D.

Reference Example 1

A 420 g portion of flaky LINOX was finely divided in a mortar to less than 100 mesh. To the resulting granules were added 80 g of ROVIMIX H-2 which had been passed through a 100 mesh sieve and 500 g of lactose and the mixture was thoroughly mixed with a rocking mixer to obtain a composition.

Reference Example 2

An 80g portion of ROVIMIX H-2 which had been passed through a 100 mesh sieve and 920 g of lactose were adequately mixed with a rocking mixer, to obtain a composition.

Reference Example 3

A 0.8 g portion of ROVIMIX H-2 which had been passed through a 100 mesh sieve and 999.2 g of lactose were adequately mixed with a rocking mixer, to obtain a composition.

Reference Example 4

A 500 g portion of KOROLAC D which had been passed through a 100 mesh sieve and 500 g of lactose were adequately mixed with a rocking mixer, to obtain a composition.

Experimental Example 1 Prophylactic effect in dogs

Eighteen household-bred dogs having a body weight of 5.0 ± 1.0 kg and with a history of dermatosis were arbitrarily selected and divided into 3 groups, A, B and C, each consisting of 6 dogs. Dog food was mixed with the following three types of the composition so as to provide a daily intake of 0.1 g per 1 kg of body weight; the composition obtained in Example 1 for group A, the composition obtained in Reference Example 1 for group B, and lactose alone for group C. The dogs were fed three times a day. Each of the components in 1 gram of the composition given to each group is identified in Table 1.

The above experiment was conducted over a 2 month period, during which the condition of the skin was observed on the basis of the evidence of itching, redness, eczema, alopecia and crusts. The results are shown in Table 2.

TABLE 1

	Each component in 1 gram of the composition given to each group (mg)		
	Group A	Group B	Group C
γ -linolenic acid	42	42	0
Biotin	1.6	1.6	0
KOROLAC D	500	0	0
Lactose	0	500	1000

TABLE 2

	Number of dogs suffering from dermatosis		
	Group A	Group B	Group C
Number of dogs	1	4	6

As shown in Table 2, dermatosis can be prevented by feeding the dog food containing the composition of the present invention to dogs.

Experimental Example 2 Prophylactic effect in dogs

Six household-bred dogs having a body weight of 5.0 ± 1.0 kg and with a history of dermatosis were arbitrarily selected. Separately from dog food, the composition obtained in Example 1 was ingested once a day, in an amount of 0.1 g per 1 kg of body weight.

The experiment was conducted over a 2 month period, during which the condition of the skin was observed on the basis of the evidence of itching, redness, eczema, alopecia and crusts. It was observed that dermatosis occurred in only 2 dogs.

Experimental Example 3 Prophylactic effect in cats

Eighteen household-bred cats having a body weight of 3.5 ± 1.0 kg and with a history of dermatosis were arbitrarily selected and divided into 3 groups, A, B and C, each consisting of 6 cats. Cat food was mixed with the following three types of the composition so as to provide a daily intake of 0.1 g per 1 kg of body weight; the composition obtained in Example 1 for group A, the composition obtained in Reference Example 1 for group B, and lactose alone for group C. The cats were fed three times a day. Each of the components in 1 gram of the composition given to each group was the same as in Table 1.

The above experiment was conducted over a 2 month period, during which the condition of the skin was observed on the basis of the evidence of itching, redness, eczema, alopecia and crusts. The results are shown in Table 3.

TABLE 3

	Number of cats suffering from dermatosis		
	Group A	Group B	Group C
Number of cats	0	4	6

As shown in Table 3, dermatosis can be prevented by feeding the cat food containing the composition of the present invention to cats.

Experimental Example 4 Prophylactic effect in cats

Six household-bred cats having a body weight of 3.5 ± 1.0 kg and with a history of dermatosis were arbitrarily selected.

Separately from cat food, the composition obtained in Example 1 was ingested once a day, in an amount of 0.1 g per 1 kg of body weight.

The experiment was conducted over a 2 month period, during which the condition of the skin was observed on the basis of the evidence of itching, redness, eczema, alopecia and crusts. It was observed that dermatosis occurred in only 1 cat.

Experimental Example 5

Therapeutic effect in cats (effect when used in combination with an antipruritic agent)

Fifteen cats having a body weight of 3.5 ± 1.0 kg and suffering from eczema such as redness, etc. were divided into 5 groups, A, B, C, D and E, each consisting of 3 cats. Separately from cat food, the following three types of the composition were ingested once a day over a period of 10 days, in an amount of 0.3 g per 1 kg of body weight, the composition obtained in Example 1 to groups A and D, the composition obtained in Reference Example 1 to group B, and lactose alone to groups C and E. The condition of the skin was observed. Prednisolone ("Prednisolone injection", product of Fujita Seiyaku Co.), which was a dermatotherapeutic medicine was subcutaneously injected once a day to groups D and E in an amount of 0.4 mg/kg body weight. Each of the components in 1 gram of the composition given to each group is shown in Table 4.

TABLE 4

Each component in 1 gram of the composition (mg)

	Group A	Group B	Group C	Group D*	Group E*
γ -linolenic acid	42	42	0	42	0
Biotin	1.6	1.6	0	1.6	0
KOROLAC	500	0	0	500	0
D					
Lactose	0	500	1000	0	1000

Note: The "*" denotes the groups having simultaneous administration of prednisolone.

The symptoms on the 3rd, 7th and 10th day from the initial administration of prednisolone were determined for each cat on the basis of the score shown in Table 5. The average scores were obtained for each group, and shown in Table 6.

TABLE 5

Score for determination of skin symptoms

Skin symptoms	Scale
Completely cured	3
Considerably cured	2
Somewhat cured	1
Remained unchanged	0
Somewhat worse	-1
Considerably worse	-2
Extremely worse	-3

TABLE 6

Determination of skin symptoms

	Group A	Group B	Group C	Group D	Group E
3rd day	0.3	0	-1.3	1.0	0.7
7th day	1.0	0.7	-3.0	3.0	1.7
10th day	2.0	0.7	NT	NT	2.0

Note: NT: not tested

(1) The skin symptoms in three cats of Group C got worse on the 7th day from the initial administration, and therefore the test was suspended.
(2) The skin in all 3 cats of Group D was completely recovered on the 7th day from the initial administration, and therefore the test was suspended.

As shown in Table 6, dermatosis is treated by having cats ingest the prescription diet composition of the present invention, and the therapeutic effect is enhanced when it is used in combination with a dermatotherapeutic medicine. It is possible to reduce the dosage of the dermatotherapeutic medicine, and thus to minimize the occurrence of side effects due to the dermatotherapeutic medicine.

Experimental Example 6 Therapeutic effect in dogs

Ten dogs having a body weight of 10.0 ± 1.0 kg and suffering from slight eczema such as redness, etc. were divided into 5 Groups, A, B, C, D and E, each consisting of 2 dogs. Separately from dog food, the three types of the composition were ingested once a day over a period of 14 days, in an amount of 0.25 g per 1 kg of body weight. The composition obtained in Example 2 to Group A, the compositions obtained in Reference Examples 2, 3 and 4 to Groups B, C and D, respectively, and lactose alone to Group E. The condition of the skin was observed. Each of the components in 1 gram of the composition given to each group is shown in Table 7.

TABLE 7

Each component in 1 gram of the composition (mg)

	Group A	Group B	Group C	Group D	Group E
Biotin	1.6	1.6	0.016	0	0
KOROLAC	500	0	0	500	0
D					
Lactose	429	920	999.2	500	1000

The symptoms on the 3rd, 7th and 14th day were determined for each dog on the basis of the score shown in Table 5. The average scores were obtained for each group, and shown in Table 8.

TABLE 8

Determination of skin symptoms

	Group A	Group B	Group C	Group D	Group E
3rd day	0.5	0	-1.0	-0.5	-1.0
7th day	1.0	0.5	-2.5	-1.5	-2.5
14th day	1.5	0.5	NT	NT	NT

Note: (1) NT: not tested

The skin symptoms in the dogs of Groups C, D and E got worse on the 7th day from the initial intake, and therefore the test was suspended.

As shown in Table 8, the composition of the present invention exhibited a more notable therapeutic effect against dermatosis than the compositions containing biotin or bifidobacteria alone.

Experimental Example 7 Therapeutic effect in dogs

To a Shih Tzu dog (3 years old, female, body weight 5.5 kg) suffering with eczema and pruritus in the tail head and

pubic regions due to flea parasites. 1.25 mg of prednisolone was orally administered twice a day over a period of 5 days, separately from dog food. The skin symptoms were not alleviated, and deposition of a light pigment was also observed in the pubic region.

The dog was subjected to once-a-day intake of 0.55 g of the composition obtained in Example 1, while orally administering 1.25 mg of prednisolone twice a day. The pruritus, eczema and pigment disappeared on the 3rd day from the initial intake of the composition.

Experimental Example 8 Therapeutic effect in dogs

To an Akita dog (3 years old, male, body weight 33.0 kg) emitting a foul odor due to inflammation and purulence of the external auditory canal of the left ear, four tablets of Jumihaijo (product of Shinwa Seiyaku Co.) was orally administered once a day, and also 6.6 g of the composition obtained in Example 1 was ingested once a day, separately from dog food. The diseased part was dried and healed on the 3rd day from the initial intake of the composition.

Experimental Example 9 Therapeutic effect in cats

To a Japanese cat (10 years old, male, body weight 4.7 kg) suffering with crusts, pruritus, inflammation, alopecia on the left hind leg, and eczema of the dorsum, 4.7 mg of prednisolone and 118 mg of chloromycetin were subcutaneously injected once a day and also 1.4 g of the composition obtained in Example 1 was ingested once a day, separately from cat food. On the 7th day from the initial intake, the dorsal eczema was still slightly observed, and the pruritus and inflammation had disappeared.

Experimental Example 10 Therapeutic effect of the α -linolenic acid-containing composition in dogs

By a Shih Tzu dog (3 years old, male, body weight 4.9 kg) suffering with slight eczema including redness in the tail head region, 0.5 g of the composition obtained in Example 3 was ingested twice a day, separately from dog food. On the 10th day from the initial intake, the diseased part healed.

Experimental Example 11 Therapeutic effect of the DHA-containing composition in cats

By a Japanese cat (9 years old, female, body weight 4.9 kg) suffering with slight eczema including redness in the dorsal region, 0.5 g of the composition obtained in Example 4 was ingested twice a day, separately from cat food. On the 10th day from the initial intake of the composition, the diseased part healed.

Experimental Example 12 Therapeutic effect of the lactic acid bacteria containing composition in dog

A Shih Tzu dog (4 years old, male, body weight 6.0 kg) suffering from slight eczema including redness in the tail head region, ingested twice a day 0.5 g of the composition obtained in Example 5, separately from dog food. On the 7th day from the initial intake of the composition, the diseased part healed.

Experimental Example 13 Therapeutic effect of the butyric acid bacteria containing composition in dogs

A Shih Tzu dog (3 years old, male, body weight 5.5 kg) suffering with slight eczema including redness in the tail head region ingested twice a day 0.5 g of the composition obtained in Example 6, separately from dog food. On the 7th day from the initial intake of the composition, the diseased

What is claimed is:

1. A prescription diet composition for a pet animal, which comprises:

(i) untreated or treated cells of bacteria being selected from the group consisting of lactic acid bacteria, Bifidobacterium, butyric acid bacteria and Bacillus, said treated cells being selected from the group consisting of washed cells, dry cells, freeze-dried cells, acetone-dried cells, organic solvent-treated cells, ultrasonically treated cells, and mechanically disrupted cells; and

(ii) at least one of poly-unsaturated fatty acid being selected from the group consisting of γ -linolenic acid, α -linolenic acid, cyclopentanoic acid and docosahexaenoic acid, and

(iii) biotin.

2. A method for prophylactic or therapeutic treatment of dermatosis in a pet animal, which comprises feeding the pet animal an anti-dermatosis effective amount of the prescription diet composition of claim 1.

3. The method according to claim 2, wherein the anti-dermatosis effective amount of the prescription diet composition per day is, 0.1 g-2.5 g for pet animals having a body weight of less than 5 kg, 0.2 g-5.0 g for pet animals having a body weight of 5 kg or between 5 and 10 kg, 0.3 g-7.5 g for pet animals having a body weight of 10 kg or between 10 and 15 kg, and 0.5 g-20 g for pet animals having a body weight of about 15 kg.

4. A prescription diet composition for a dog, which comprises:

(i) untreated or treated cells of bacteria being selected from the group consisting of lactic acid bacteria, Bifidobacterium, butyric acid bacteria and Bacillus, said treated cells being selected from the group consisting of washed cells, dry cells, freeze-dried cells, acetone-dried cells, organic solvent-treated cells, ultrasonically treated cells, and mechanically disrupted cells; and

(ii) biotin.

5. A method for prophylactic or therapeutic treatment of dermatosis in a dog, which comprises feeding the dog an anti-dermatosis effective amount of the prescription diet composition of claim 4.

6. A prescription diet composition for a dog or cat which comprises an anti-dermatosis effective amount of γ -linolenic acid, untreated or treated cells of bacteria selected from the group consisting of lactic acid bacteria, Bifidobacterium, butyric acid bacteria and Bacillus, said treated cells selected from the group consisting of washed cells, dry cells, freeze-dried cells, acetone-dried cells, organic solvent-treated cells, ultrasonically treated cells or mechanically disrupted cells thereof, and biotin.

7. A method for the prophylactic or therapeutic treatment of dermatosis in a dog or cat, which comprises feeding the dog or cat the prescription diet composition of claim 6.

8. A prescription diet composition for a pet animal, which comprises an antifungal which is selected from the group consisting of lactic acid bacteria, Bifidobacterium, butyric acid bacteria, Bacillus and washed cells, dry cells, freeze-dried cells, acetone-dried cells, organic solvent-treated cells, ultrasonically treated cells, and mechanically disrupted cells of said bacteria; and at least one of poly-unsaturated fatty acid being selected from an ω 3 or ω 6 essential fatty acid, and biotin.

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